



222-1 shortwave receiver Service log  
Virgil Cheng vr2xgm

19-Mar-2025, PSU unit, History:

- Units acquired early 2000s
- 222-1 not frequently used SW receiver, put in storage
- Unit #1 dated Sep-1971, without serial number
- Unit #2 dated Feb-1974, without serial number
- Recently retrieved for inspection

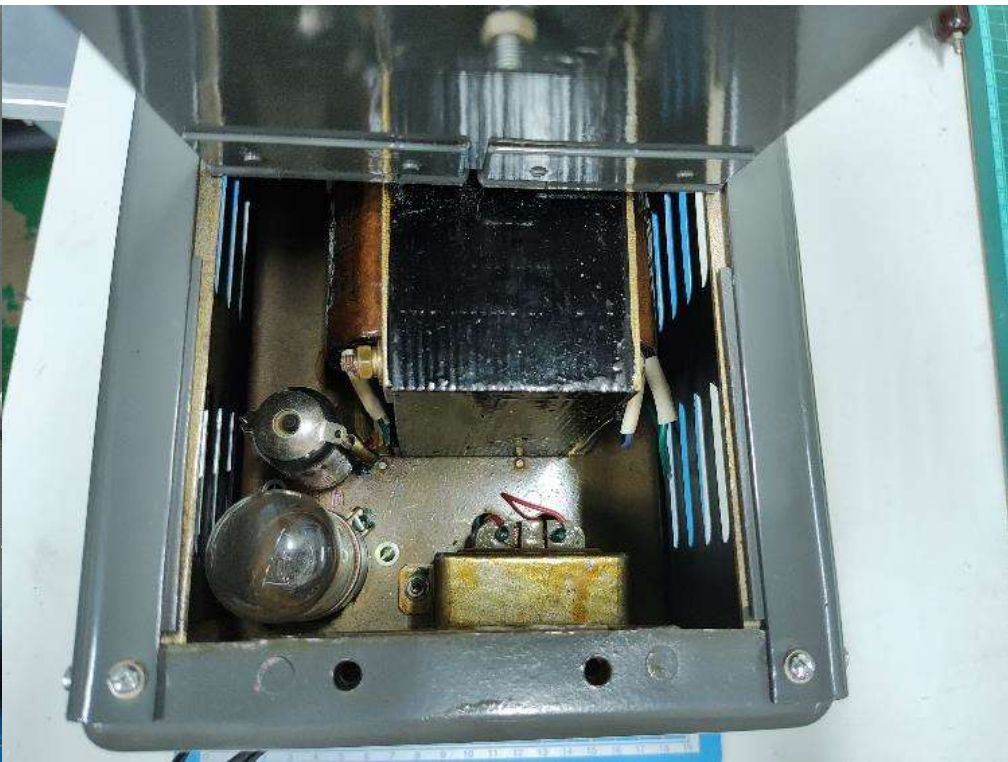
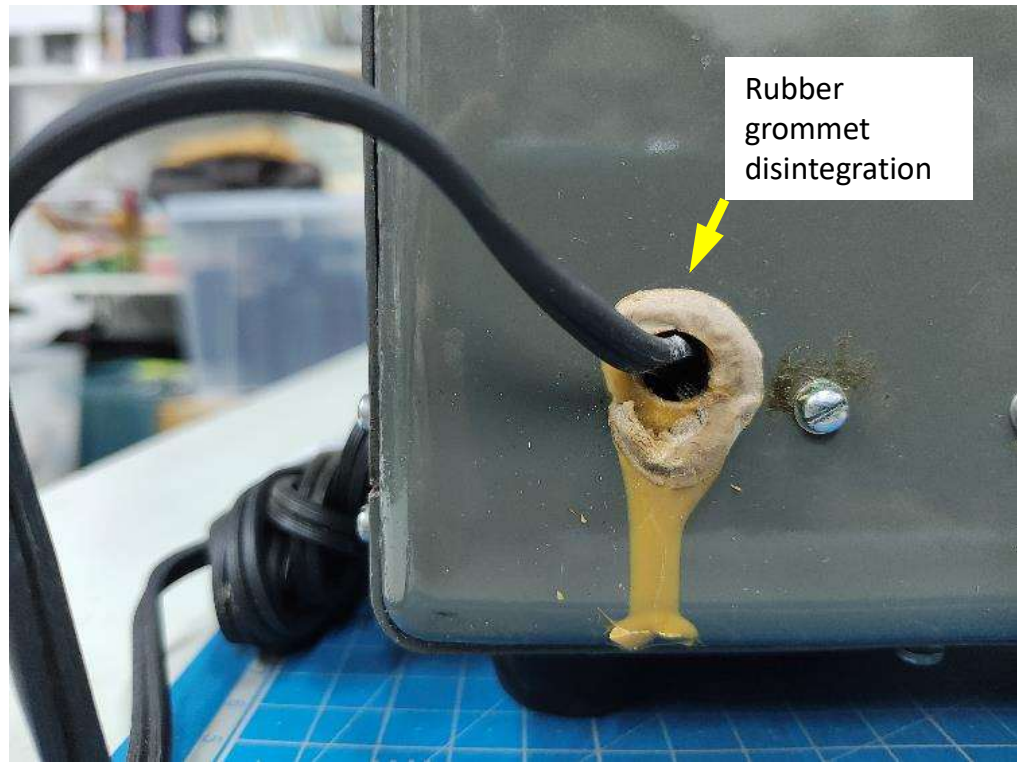
Unit #1 Sep-1971



Photos





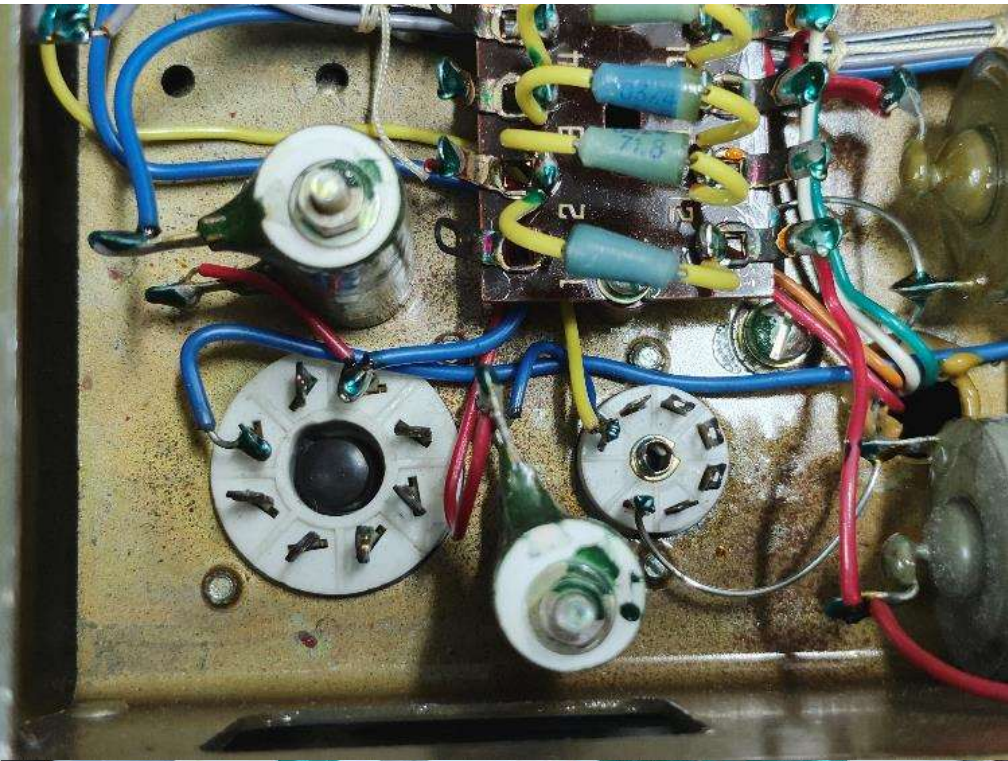




Ecap case is negative, blue jacket insulate case from chassis. Inadequate by today's standard

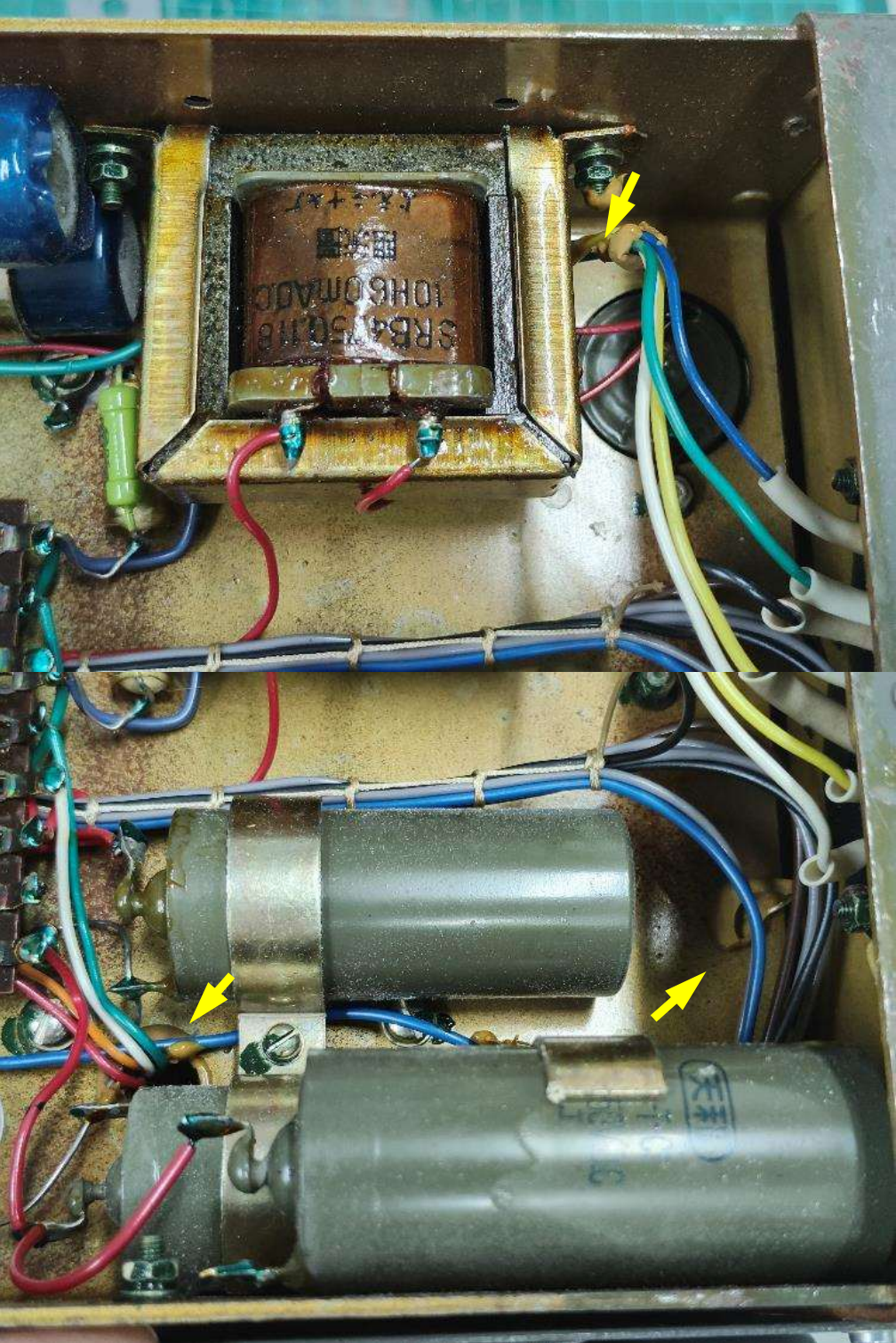


Rectifier diodes with 1971 date code

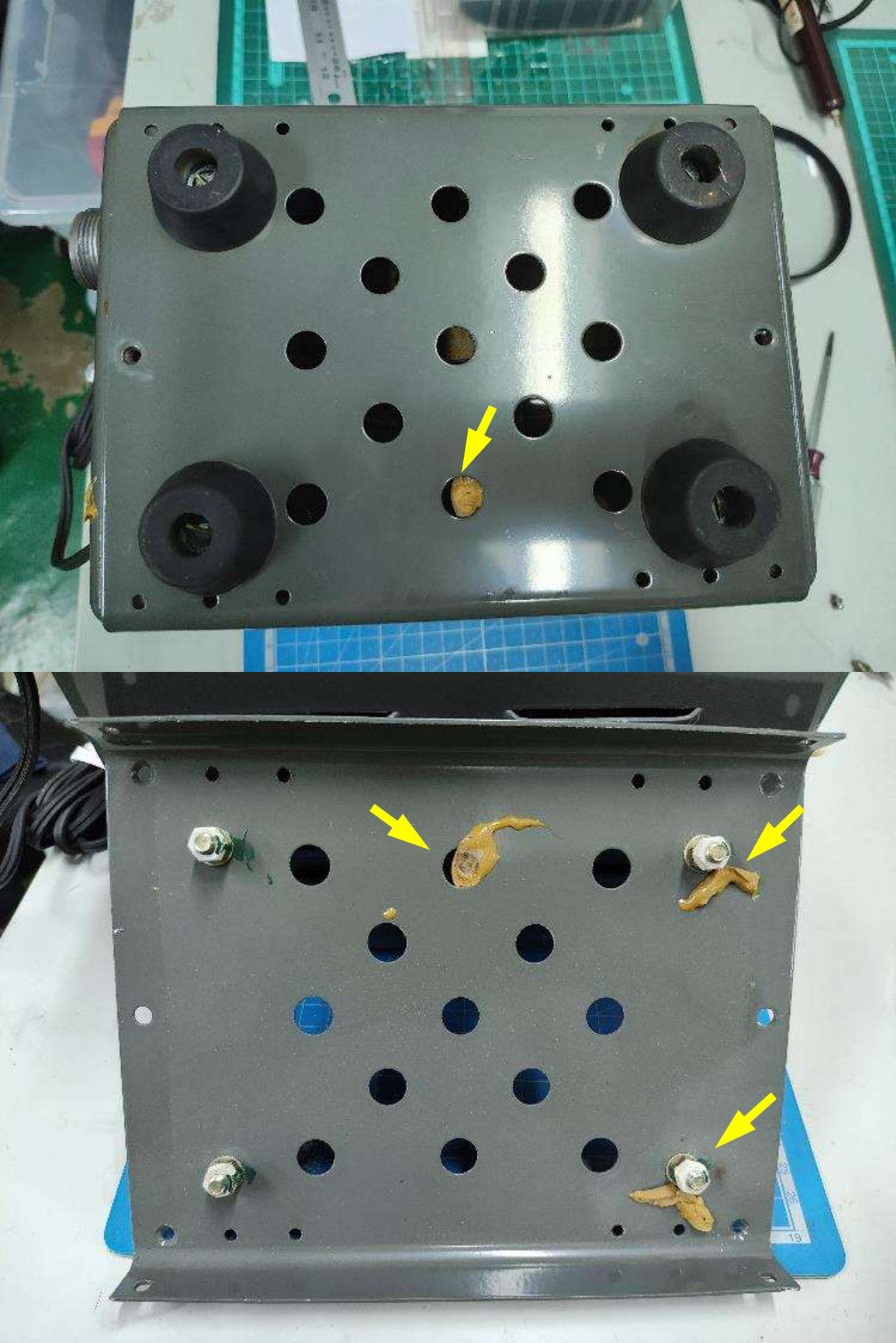




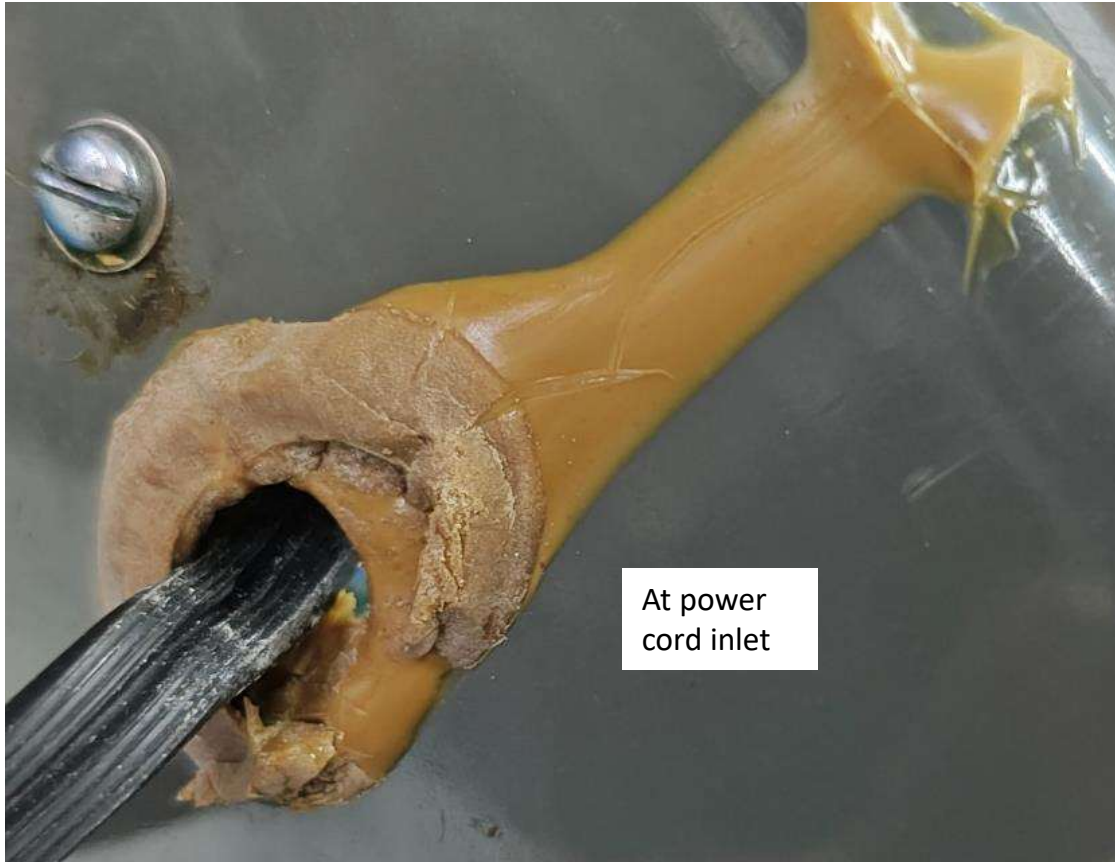
Disintegrated  
grommet dropped  
onto harness and  
chassis



Grommet residue on  
bottom cover

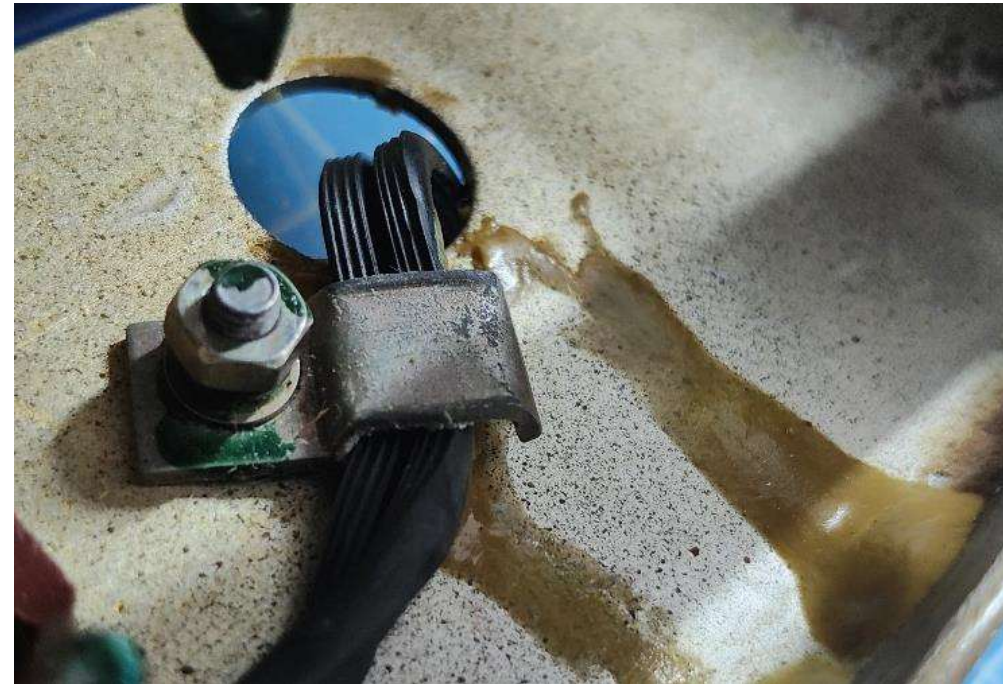
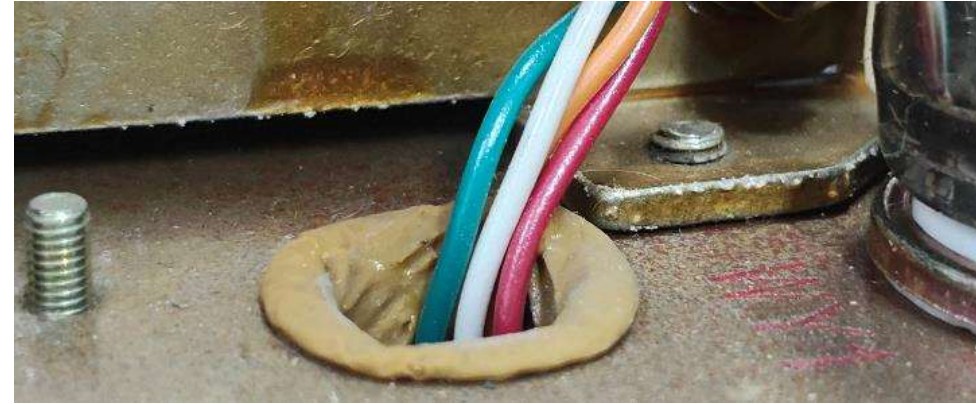






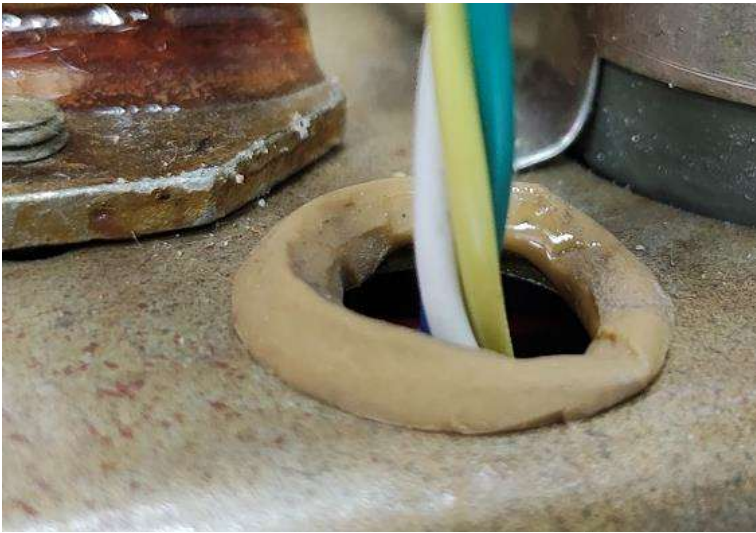
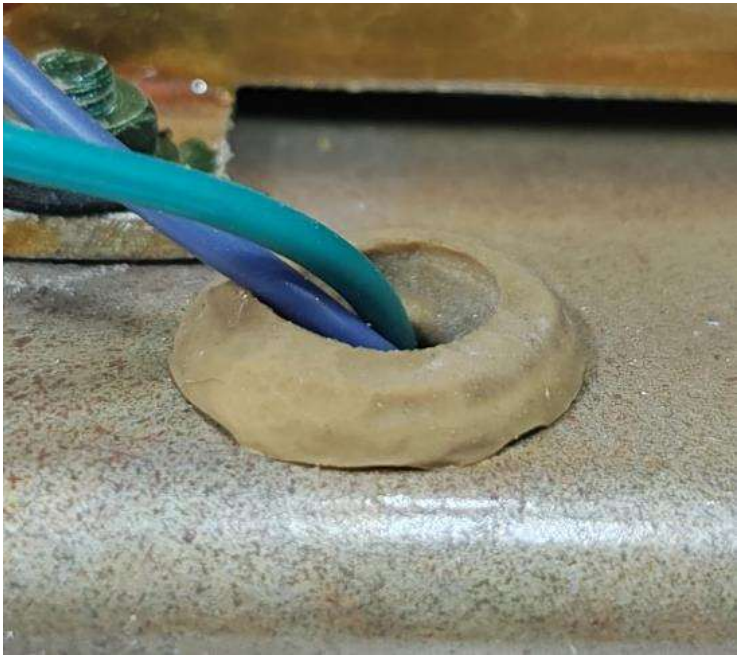
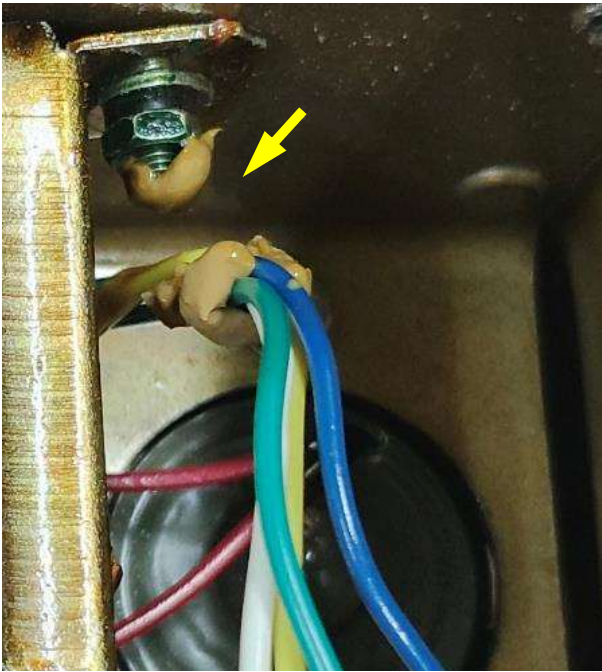
At power  
cord inlet

## Grommet disintegration





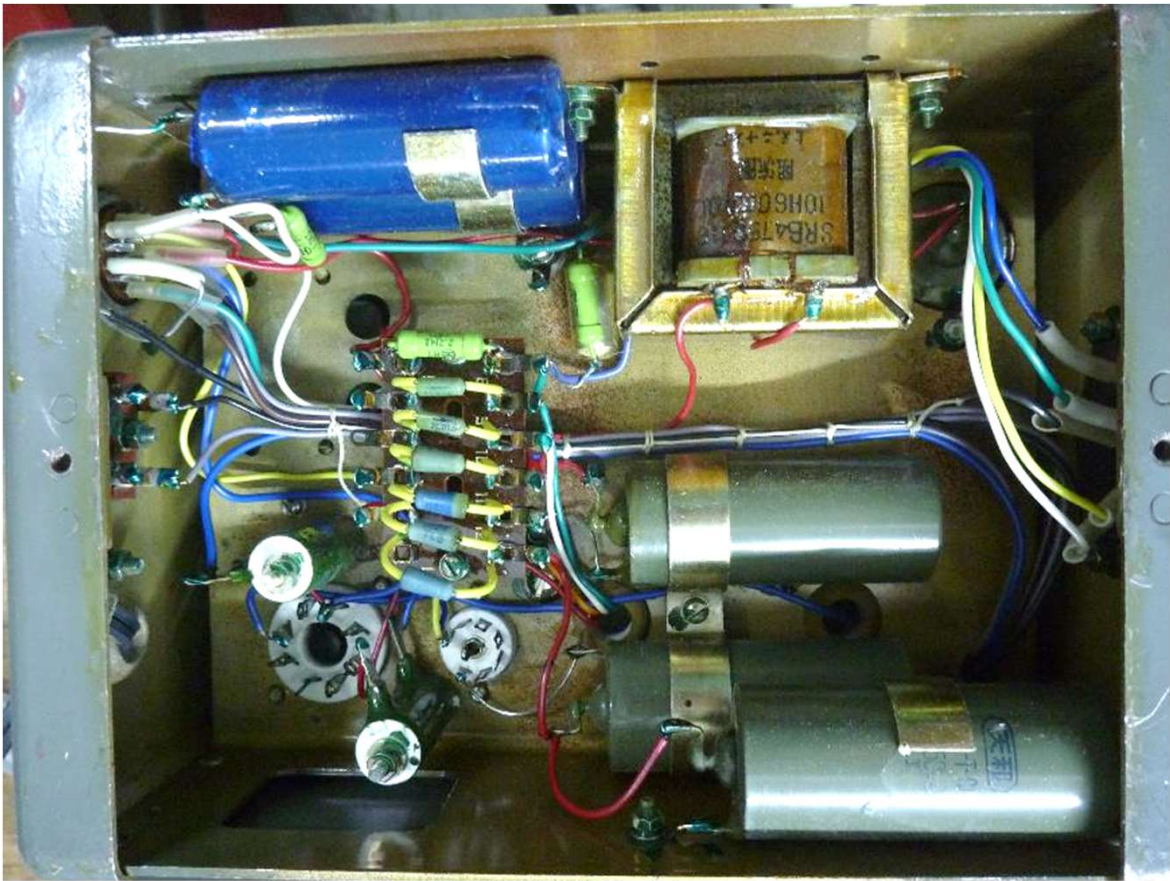
Grommet disintegration



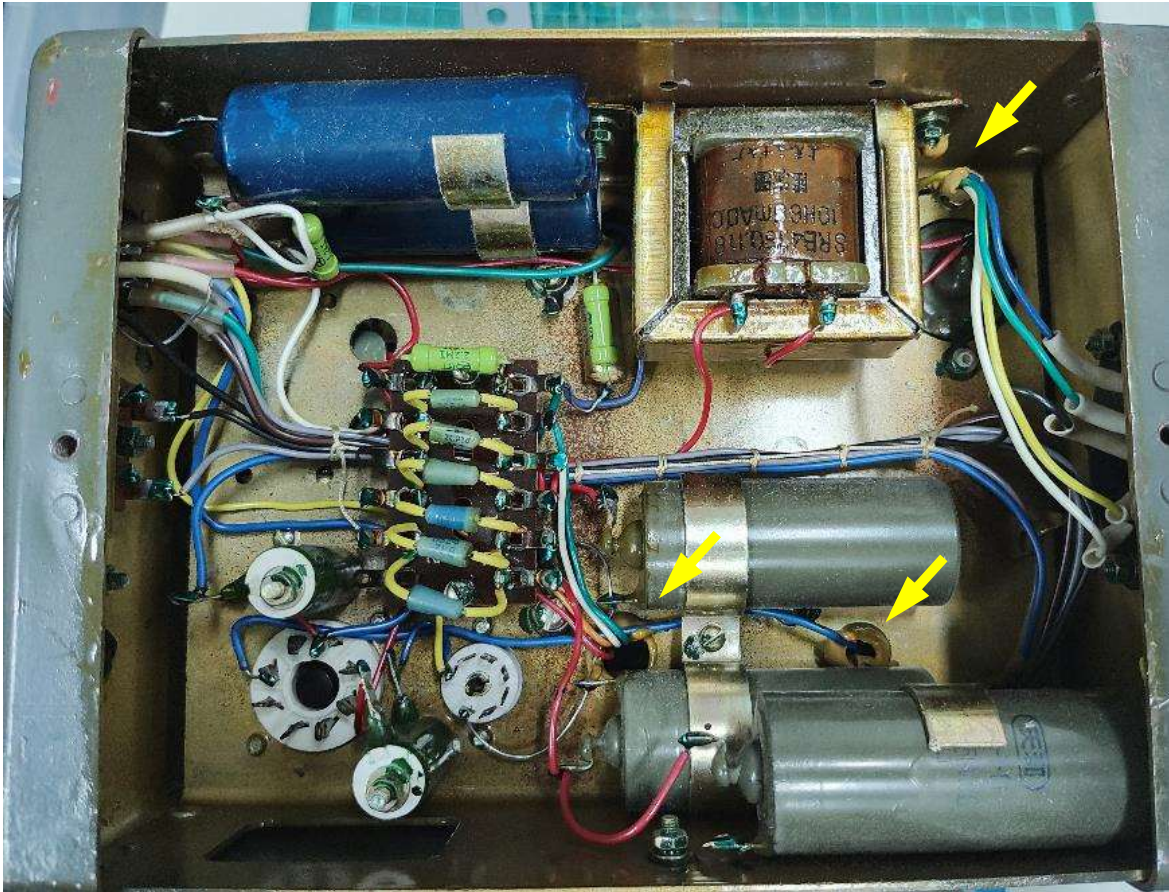


Unit condition comparison present and 14 years ago, rubber grommets melted away

Jun-2011



Mar-2025





Summary:

Visual defects:

- Rubber grommet disintegrated; fluid dropped to various places in chassis

Components in doubt:

- Electrolytic capacitors need replacement
  - Long term reliability or vintage part preservation ?
    - Sealed part, tested functional, [keep vintage part](#)
- Rectifier diodes with 1971 date code, rating lower than popular 1N400x series diode first released in 1963
  - Long term reliability or vintage part preservation ?
    - Tested functional, current rating low by today's standard, [keep vintage part for the moment](#)

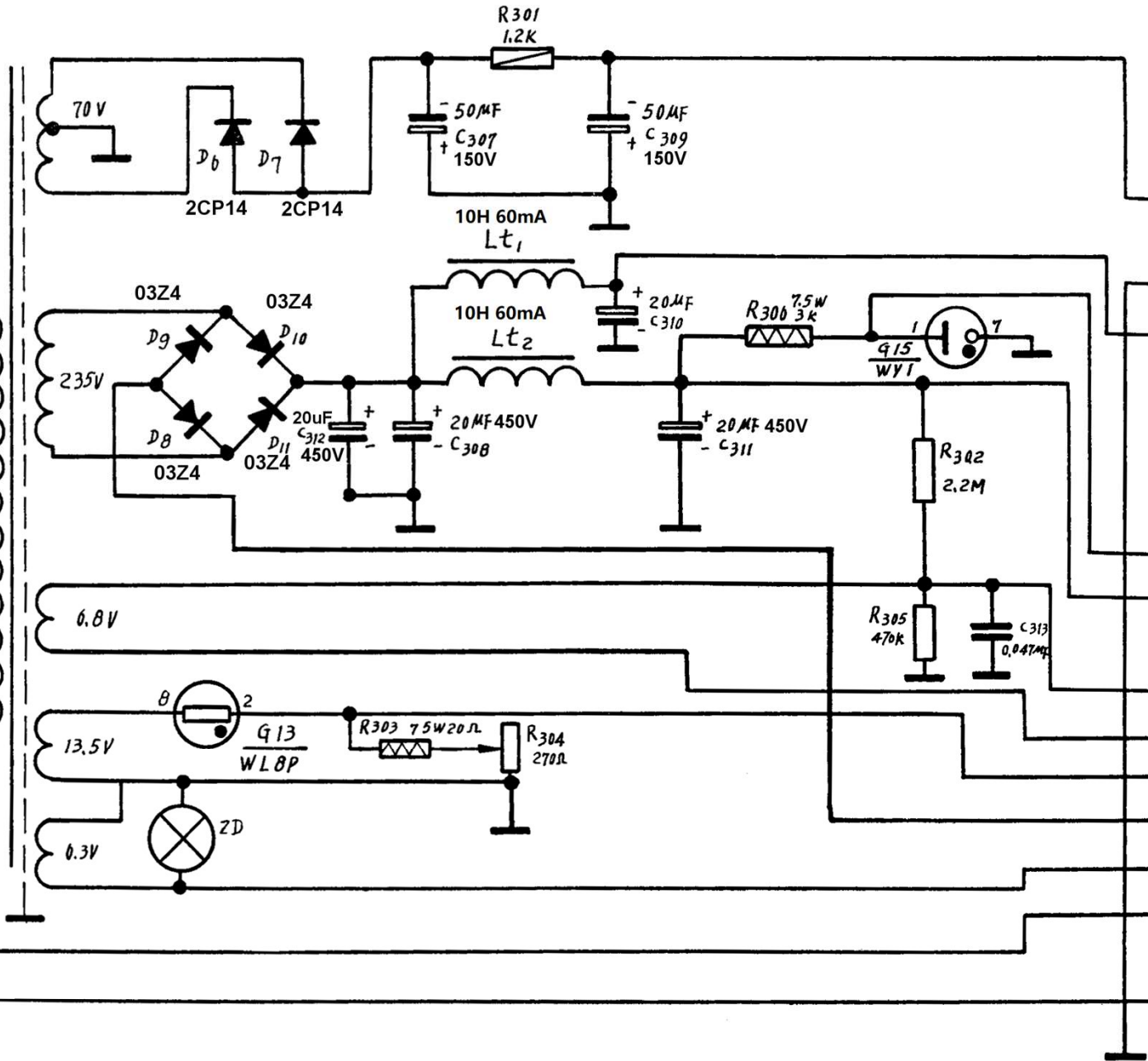
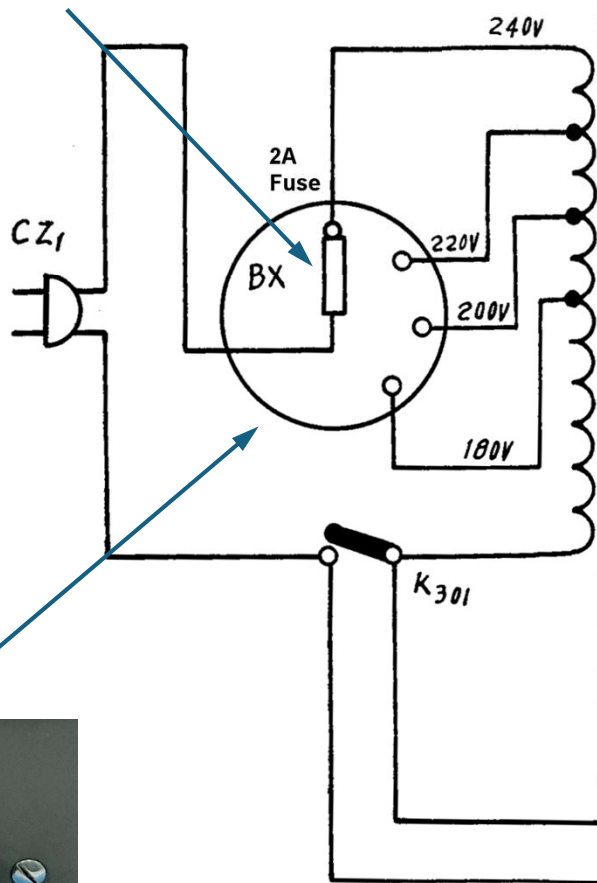
Other checks:

- Mechanical mounting
- Passive components, resistance, capacitance, ESR, ripple
- Insulation material integrity: lead wires, power cord/plug, terminals, insulation sleeves
- Switch, voltage selector
- Indicator
- Clearances, creepage distances
- Tubes, tube sockets



PSU schematic, operator's manual pg.55

Fuse inside voltage selector  
Rotate anticlockwise one step  
beyond 240V position to eject fuse  
from side slot, **DO NOT PULL**, this is  
**NOT** a plug

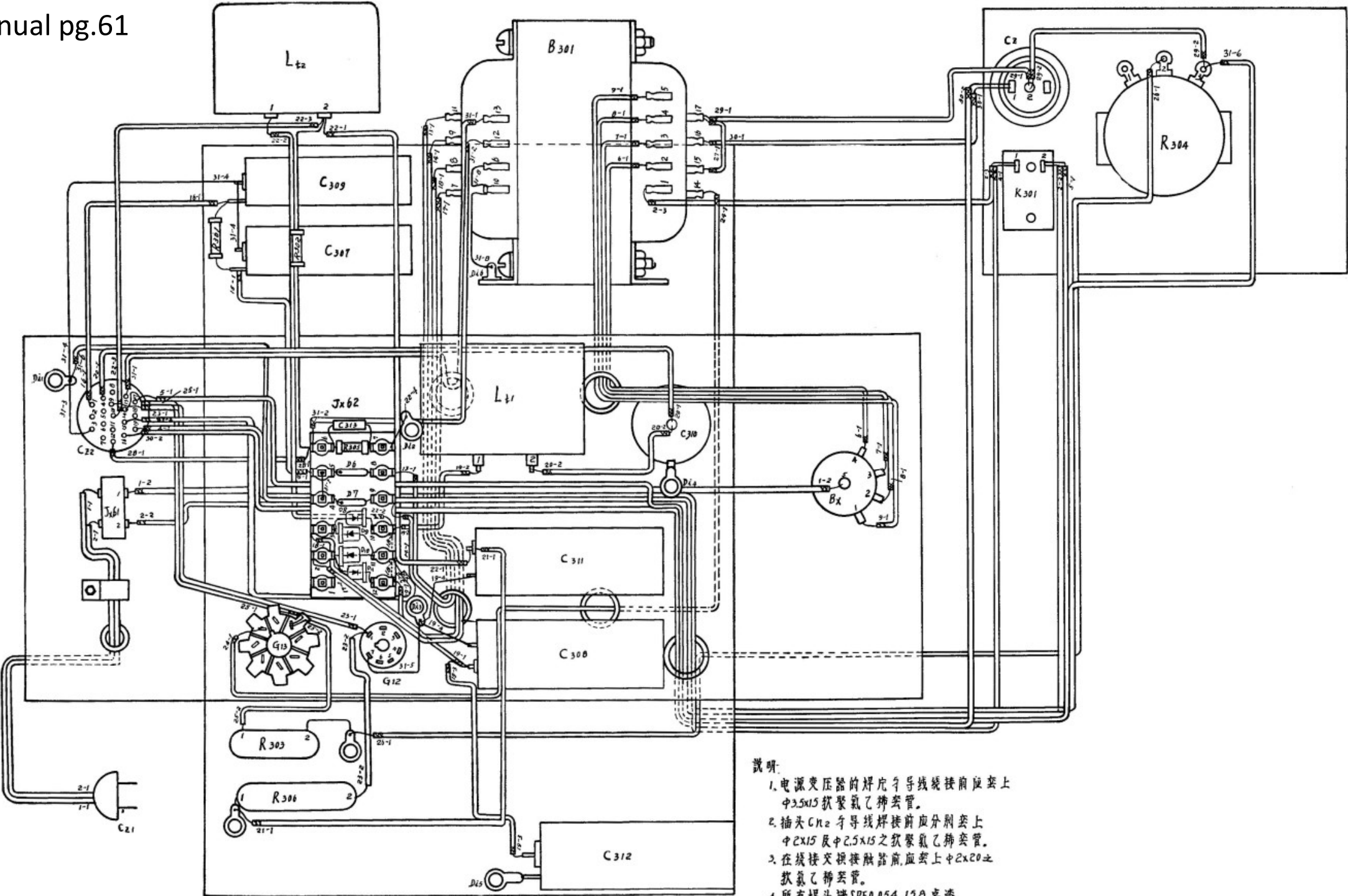


| CZ <sub>2</sub> |                |
|-----------------|----------------|
| 编号              | 特性             |
| 1               | -40V           |
| 2               |                |
| 3               | 地              |
| 4               | +250 (910 911) |
| 5               |                |
| 6               |                |
| 7               |                |
| 8               |                |
| 9               | +150V (稳)      |
| 10              | +250V          |
| 11              |                |
| 12              | ~6.0V (+40V)   |
| 13              | 0              |
| 14              | ~6.3V (稳)      |
| 15              | 0              |
| 16              | ~6.3V          |
| 17              | ~220V          |
| 18              |                |
| 19              | ~220V          |

Update 6-Apr-2025

4. 整流器电原理图





- 說明:
- 1. 电源变压器的焊片与导线接前应在套上中3.5x15 款聚氯乙稀套管。
  - 2. 插头C112 与导线焊接前应分别套上中2x15 及中2.5x15 之款聚氯乙稀套管。
  - 3. 在焊接交换接触器前,应在套上中2x20 之款聚氯乙稀套管。
  - 4. 所有焊头抹SPE0.054.150 漆。

10. 整 流 器 接 线 图



|                 |  |                   |  |   |                                 |
|-----------------|--|-------------------|--|---|---------------------------------|
| D <sub>6</sub>  |  | 硅二极管 2CP14        |  | 1 | Diode Si, 200V 0.1A, 2CP14      |
| D <sub>7</sub>  |  | 硅二极管 2CP14        |  | 1 | Diode Si, 200V 0.1A, 2CP14      |
| D <sub>8</sub>  |  | 硅二极管 03Z4 (2CP24) |  | 1 | Diode Si, 400V 0.3A, 03Z4/2CP24 |
| D <sub>9</sub>  |  | 硅二极管 03Z4 (2CP24) |  | 1 | Diode Si, 400V 0.3A, 03Z4/2CP24 |
| D <sub>10</sub> |  | 硅二极管 03Z4 (2CP24) |  | 1 | Diode Si, 400V 0.3A, 03Z4/2CP24 |
| D <sub>11</sub> |  | 硅二极管 03Z4 (2CP24) |  | 1 | Diode Si, 400V 0.3A, 03Z4/2CP24 |

|                  |  |                                 |  |   |   |
|------------------|--|---------------------------------|--|---|---|
| C <sub>307</sub> |  | 电容器 CDM-T-150-50-C <sub>1</sub> |  | 1 | Capacitor, electrolytic, sealed Aluminum, 50uF 150V, CDM-T series |
| C <sub>308</sub> |  | 电容器 CDM-T-450-20-C <sub>1</sub> |  | 1 | Capacitor, electrolytic, sealed Aluminum, 20uF 450V, CDM-T series |
| C <sub>309</sub> |  | 电容器 CDM-T-150-50-C <sub>1</sub> |  | 1 | Capacitor, electrolytic, sealed Aluminum, 50uF 150V, CDM-T series |
| C <sub>310</sub> |  | 电容器 CDM-T-450-20-C <sub>1</sub> |  | 1 | Capacitor, electrolytic, sealed Aluminum, 20uF 450V, CDM-T series |
| C <sub>311</sub> |  | 电容器 CDM-T-450-20-C <sub>1</sub> |  | 1 | Capacitor, electrolytic, sealed Aluminum, 20uF 450V, CDM-T series |
| C <sub>312</sub> |  | 电容器 CDM-T-450-20-C <sub>1</sub> |  | 1 | Capacitor, electrolytic, sealed Aluminum, 20uF 450V, CDM-T series |
| C <sub>313</sub> |  | 电容器 CZJX-400-0.047-Ⅰ            |  | 1 | Capacitor, metallized paper dielectric , 47nF 400V, CZJX series   |



1. 整 流 二 极 管

| 序<br>号 | 型<br>号 | 最 高<br>反 向<br>工 作<br>电 压<br><br>$V_{RM}$<br>[25℃, $I_{R1}$ ]<br>(V) | 额 定<br>整 流<br>电 流<br><br>$I_F$<br>(A) | 最 大<br>正 向<br>压 降<br><br>$V_F$<br>[25℃, $I_F$ ]<br>(V) | 最 大 反 向 电 流                         |                                 |            | 浪 涌              |              | 最 高<br>结 温<br><br>$T_{JM}$<br>(℃) | 材 料<br>或<br>结 构 | 外<br>形 | 序<br>号 |
|--------|--------|---|---------------------------------------|--|-------------------------------------|---------------------------------|------------|------------------|--------------|-----------------------------------|-----------------|--------|--------|
|        |        |   |                                       |  | $I_{R1}$<br>[25℃, $V_{RM}$ ]<br>(A) | $I_{R2}$<br>[ $V_{RM}$ ]<br>(A) | $T$<br>(℃) | $I_{RSM}$<br>(A) | $t_U$<br>(s) |                                   |                 |        |        |
| 34     | 2C P14 | 200   | 0.1                                   | 1.5  | 5 $\mu$                             | 100 $\mu$                       | 100        | 2                | 10m          | 150                               | Si•             | EH-2   | 34     |
| 35     | 2C P14 | 200   | 0.1                                   | 1.5  | 5 $\mu$                             | 20 $\mu$                        | 70         |                  |              |                                   |                 | EA-3   | 35     |
| 36     | 2C P14 | 200   | 0.1                                   | 1.2  |                                     | 5 $\mu$                         | 100        |                  |              | 150                               | Si0             | EA-3   | 36     |

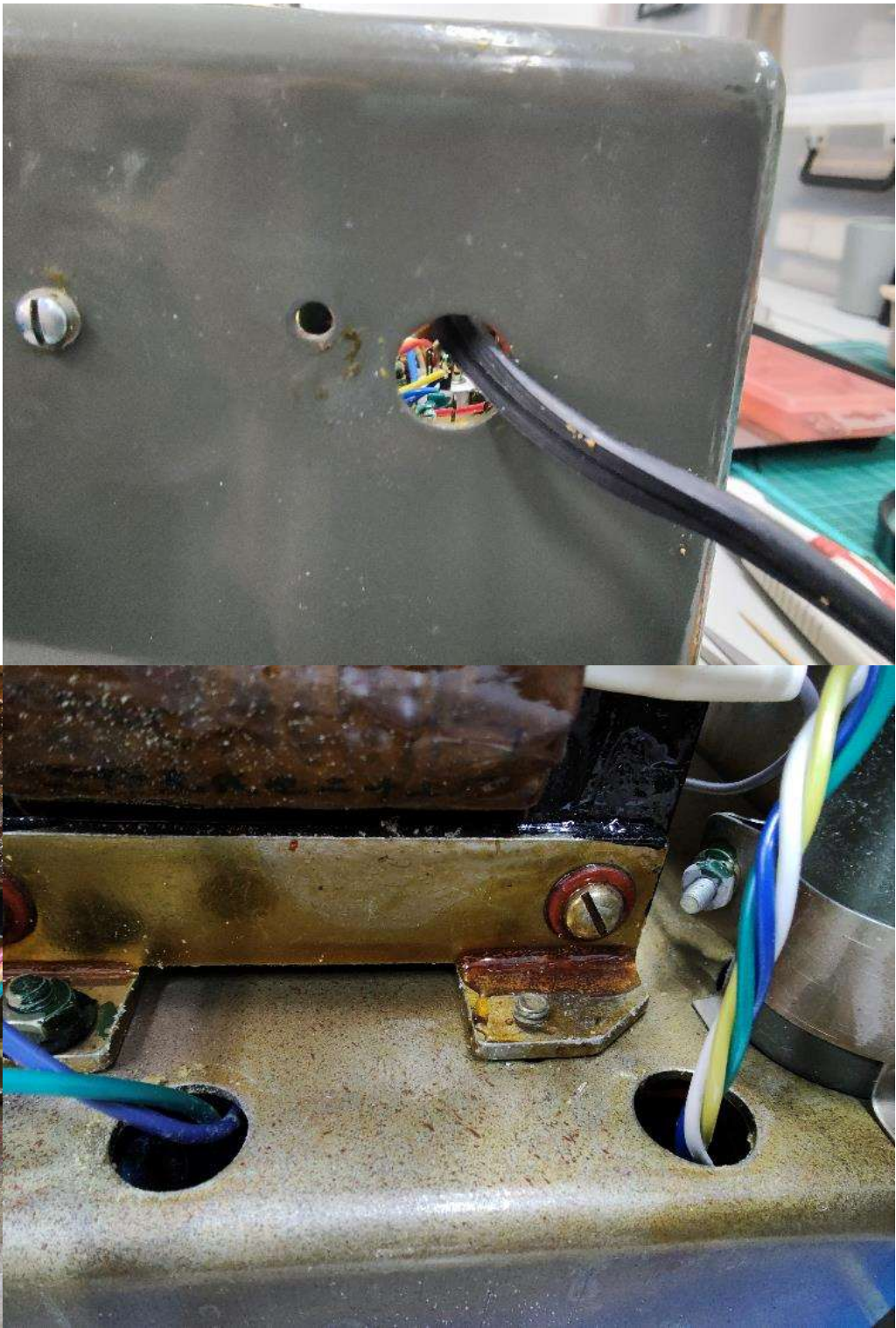
1. 整 流 二 极 管

| 序<br>号 | 型<br>号  | 最 高<br>反 向<br>工 作<br>电 压<br><br>$V_{RM}$<br>[25℃, $I_{R1}$ ]<br>(V) | 额 定<br>整 流<br>电 流<br><br>$I_F$<br>(A) | 最 大<br>正 向<br>压 降<br><br>$V_F$<br>[25℃, $I_F$ ]<br>(V) | 最 大 反 向 电 流                         |                                 |            | 浪 涌              |              | 最 高<br>结 温<br><br>$T_{JM}$<br>(℃) | 材 料<br>或<br>结 构 | 外<br>形 | 序<br>号 |
|--------|---------|---|---------------------------------------|--|-------------------------------------|---------------------------------|------------|------------------|--------------|-----------------------------------|-----------------|--------|--------|
|        |         |   |                                       |  | $I_{R1}$<br>[25℃, $V_{RM}$ ]<br>(A) | $I_{R2}$<br>[ $V_{RM}$ ]<br>(A) | $T$<br>(℃) | $I_{FSM}$<br>(A) | $t_U$<br>(s) |                                   |                 |        |        |
| 17     | 2C P24  | 400   | 0.3                                   | 1  | 5 $\mu$                             | 100 $\mu$                       | 100        | 6                | 10m          | 140                               | Si•             | EH-2   | 18     |
| 35     | 2C P24  | 400   | 0.3                                   | 1  | 250 $\mu$                           |                                 |            |                  |              |                                   | Si•             | EH-2   | 35     |
| 36     | 2A P77  | 400   | 0.3                                   | 0.5  | 300 $\mu$                           |                                 |            |                  |              |                                   | Ge•             | EE     | 36     |
| 37     | 2C Z83F | 400   | 0.3                                   | 1  | 5 $\mu$                             | 100 $\mu$                       | 100        | 6                | 10m          | 130                               | Si•             | DO-15  | 37     |
| 38     | 2C P24  | 400   | 0.3                                   | 1  | 5 $\mu$                             |                                 |            |                  |              |                                   | Si•             | EH-3   | 38     |
| 39     | 2C P24  | 400   | 0.3                                   | 1  | 5 $\mu$                             | 100 $\mu$                       | 100        | 6                | 10m          |                                   | Si•             | D15-10 | 39     |



Hole size:  $\phi 12\text{mm}$ , metal sheet thickness 1.8mm

| Grommet sizes       |                 |    |    |
|---------------------|-----------------|----|----|
| Panel thickness     | 2               |    | mm |
| Panel hole diameter | 12              | 10 | mm |
| Cable size          | 10              | 8  | mm |
| Material            | Silicone rubber |    |    |





First grommet replacement, de-solder ballast tube terminal, insert grommet, re-route wire, time consuming

Original solder joint



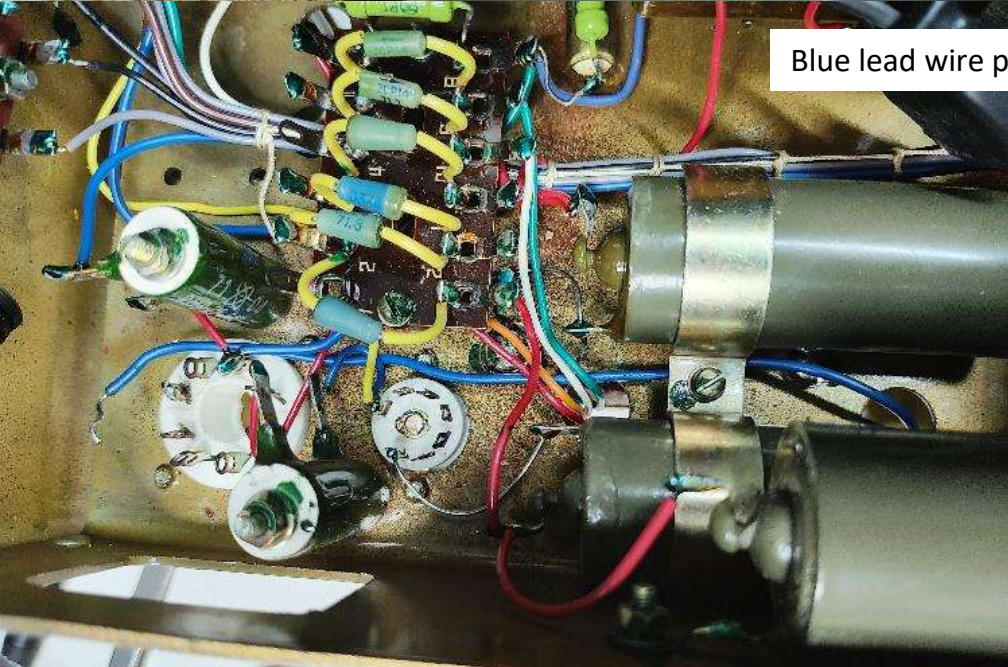
Chassis hole cleaned



De-solder



Blue lead wire path







Re-solder

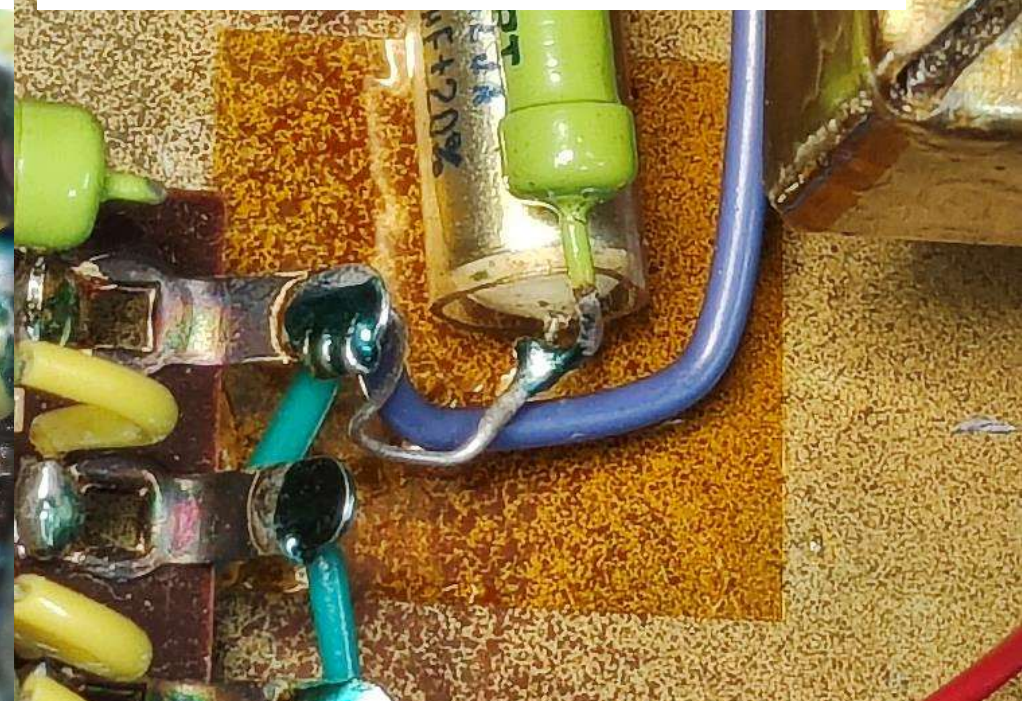


Hole with new  
Silicone grommet

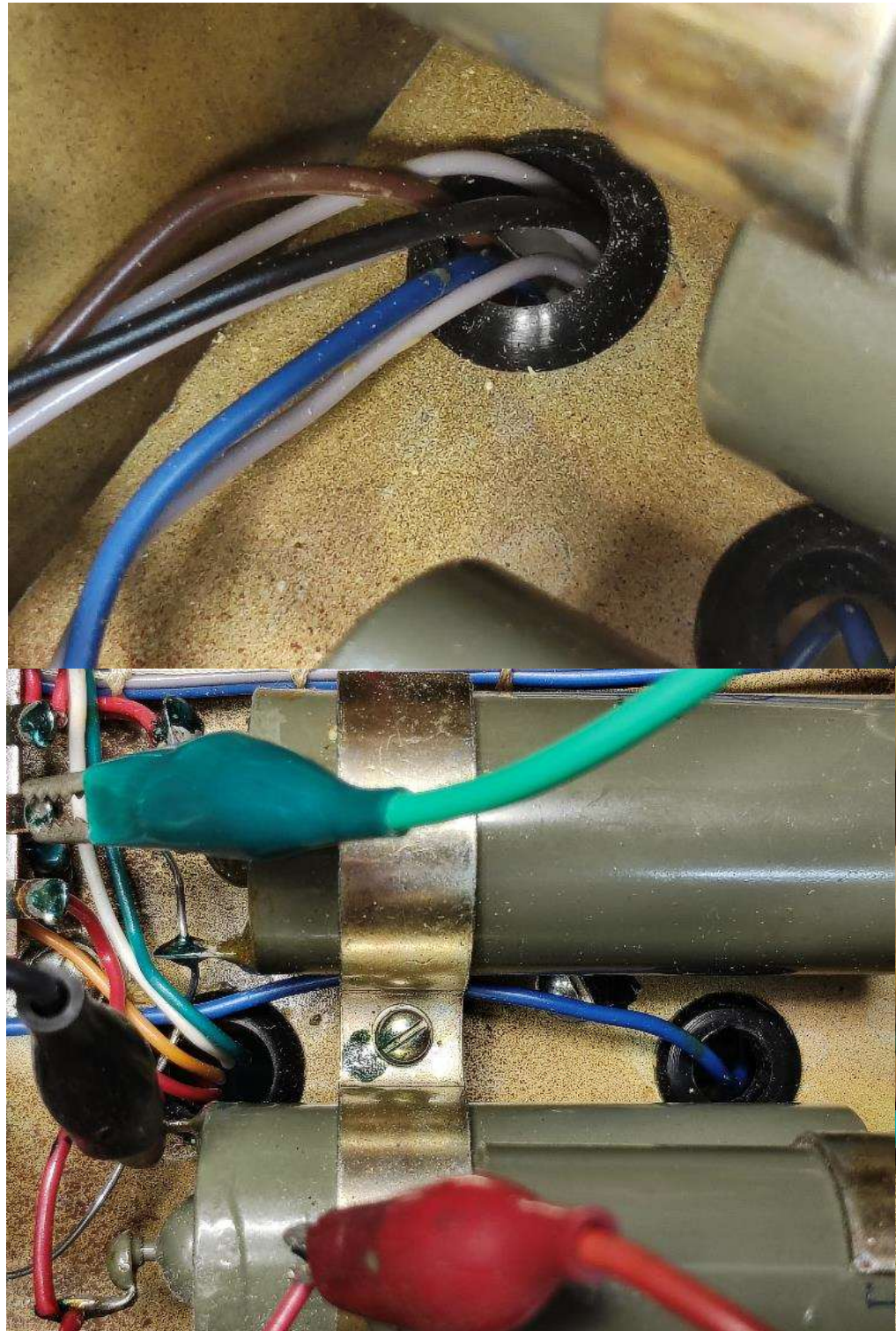
Adding Kapton tape on resistor body to avoid heating wire insulation



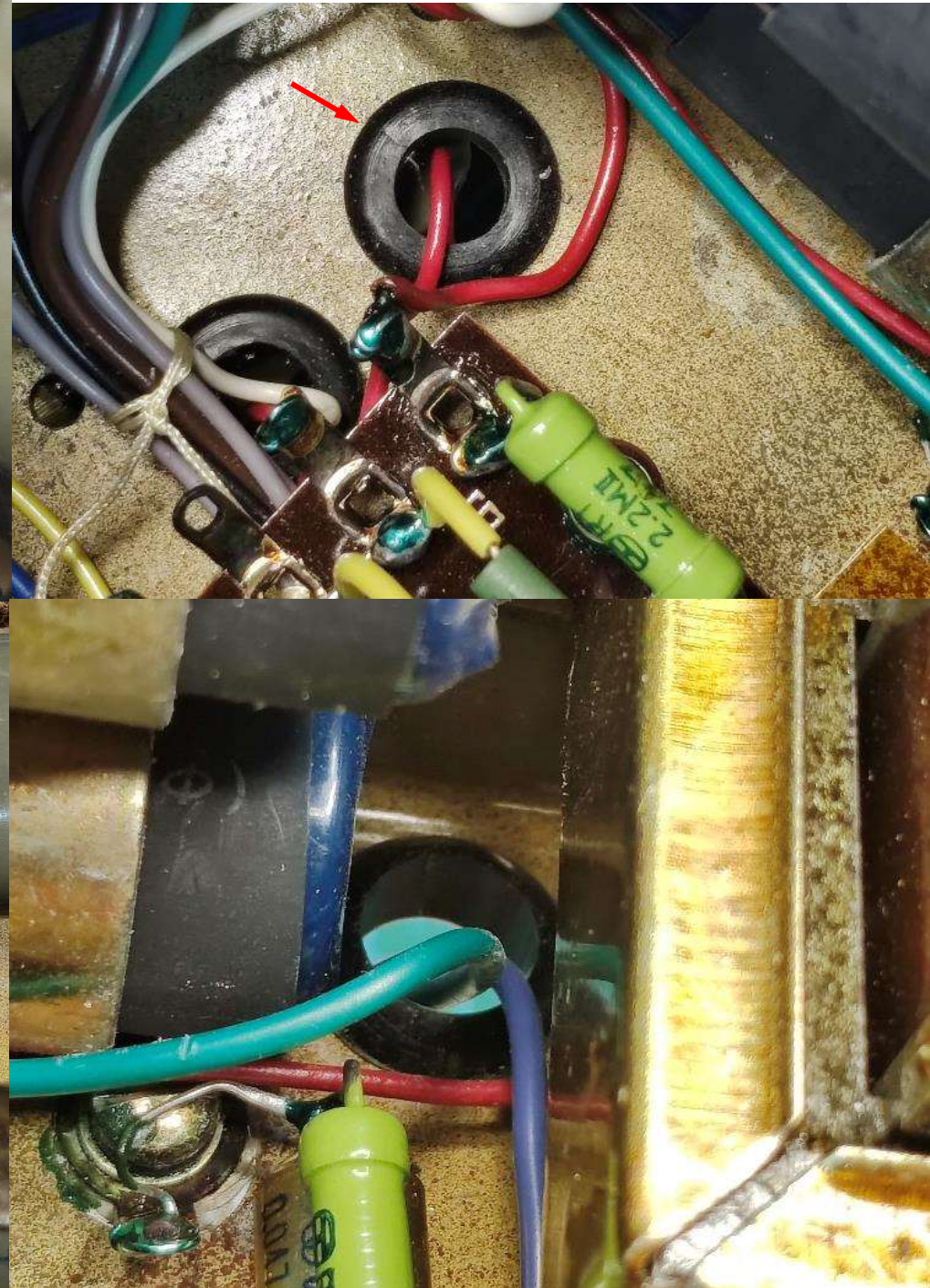
Adding Kapton tape on chassis for better creepage distance





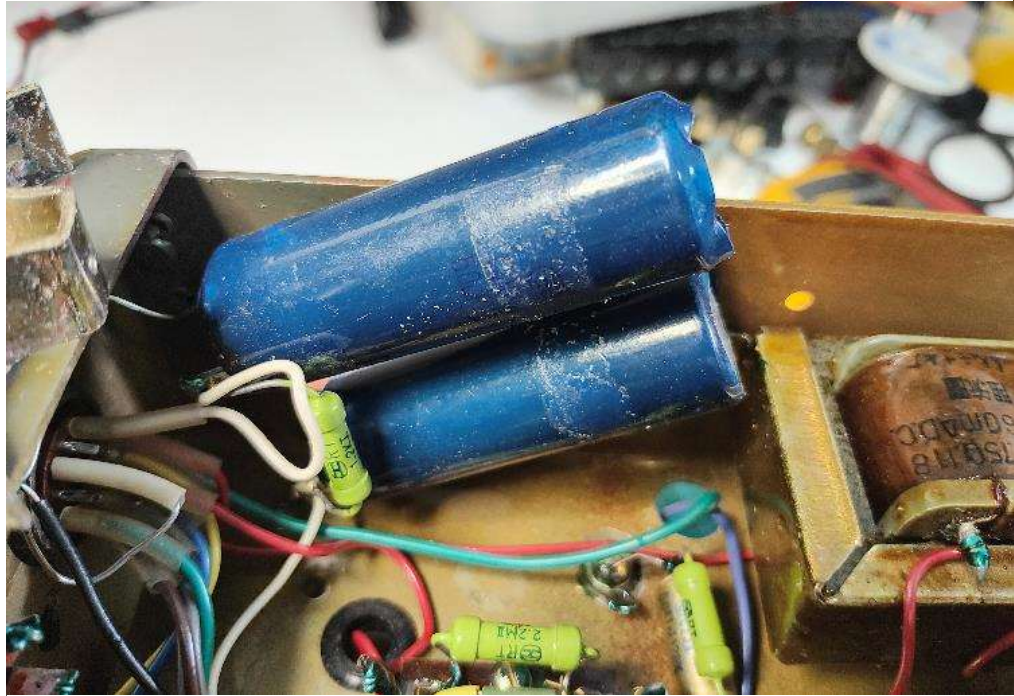


Holes with new grommets, these were done by cutting/splitting grommet allowing insertion without de-soldering many wires





Adding heat shrinkable tube on capacitors casing

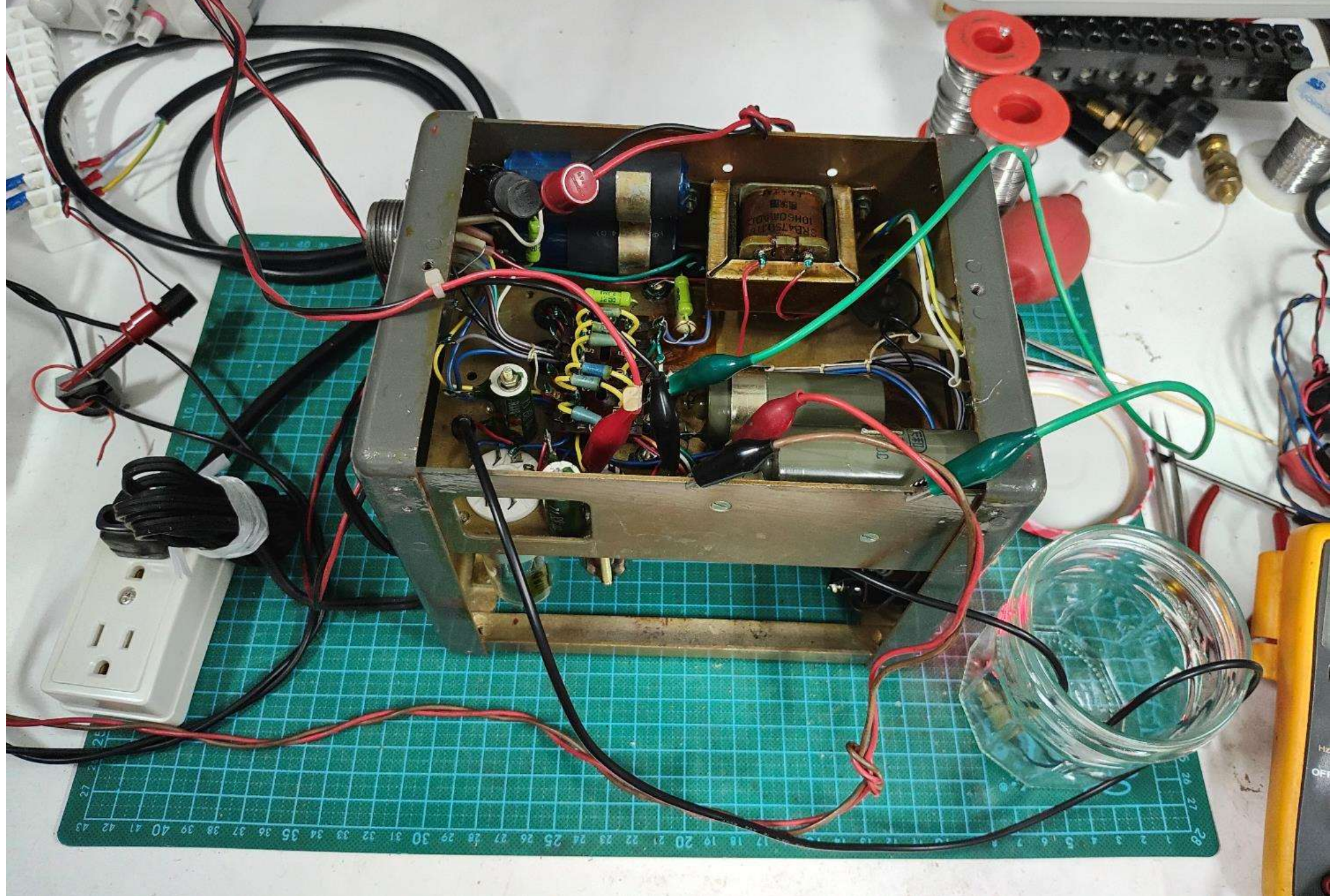


AC power cord, new grommet, de-solder, re-solder, add heat shrinkable tubes





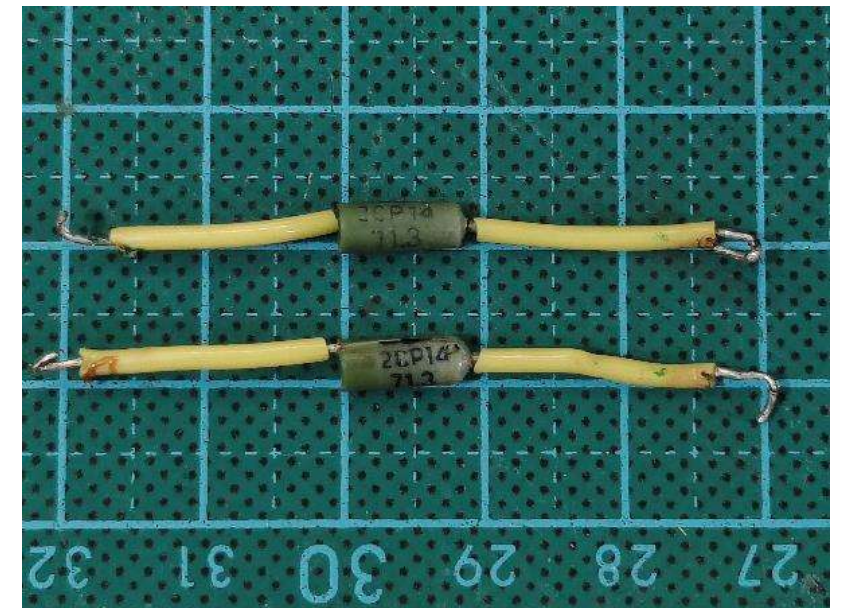
PSU unit check, monitoring capacitor voltages, regulated filament AC power:  $6K4(0.3A)+6U1(0.3A)+6J1(0.17A)=0.77A$ , loaded with  $8\Omega$  resistor





## Rectifier diodes replacement 29-Mar-2025

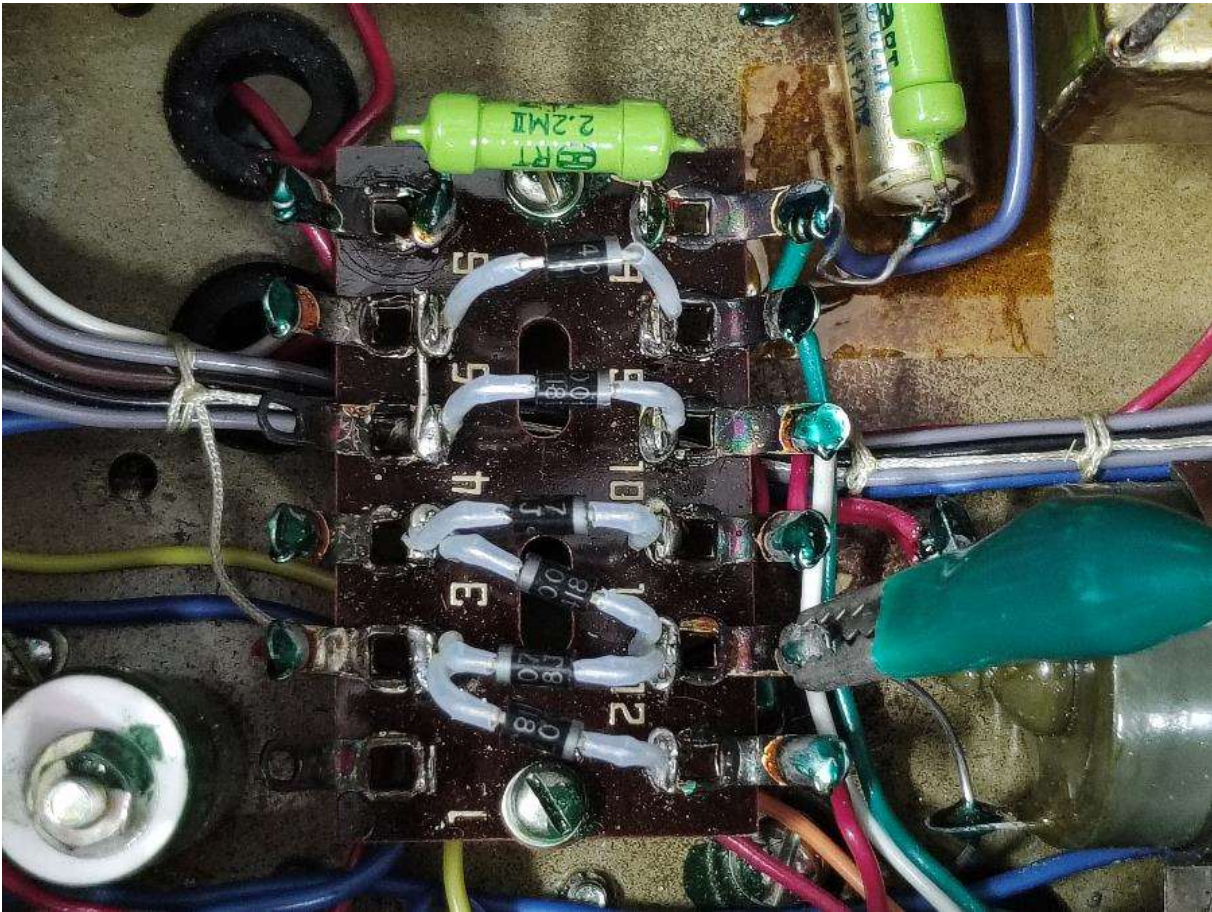
- Noticed -40V output dropped rapidly ( $\sim 10$ s to -3V) at power off after few hours burn-in
- $\sim 3$ V p-p 50Hz (not 100Hz) ripple observed at unloaded -40V output
  - Output unloaded and total capacitance is 100uF, indicates excessive leakage present
  - Capacitors C307/309 check good, capacitance 77uF/82uF leakage  $\sim 15$ uA at 30VDC
  - Disconnect capacitors -40V output measured 22K resistance to ground/chassis
  - D7 diode check ok but measured 22K with multimeter resistance range, leakage current measured 215uA at 30V reverse bias, note 2CP14 leakage current varies with different manufacturer, ranges from 5uA to 100uA, 215uA far exceeded most relaxed spec.
  - Vintage rectifiers quality questionable, replaced





Rectifier diodes replaced 29-Mar-2025

1N4007 x 6 pcs



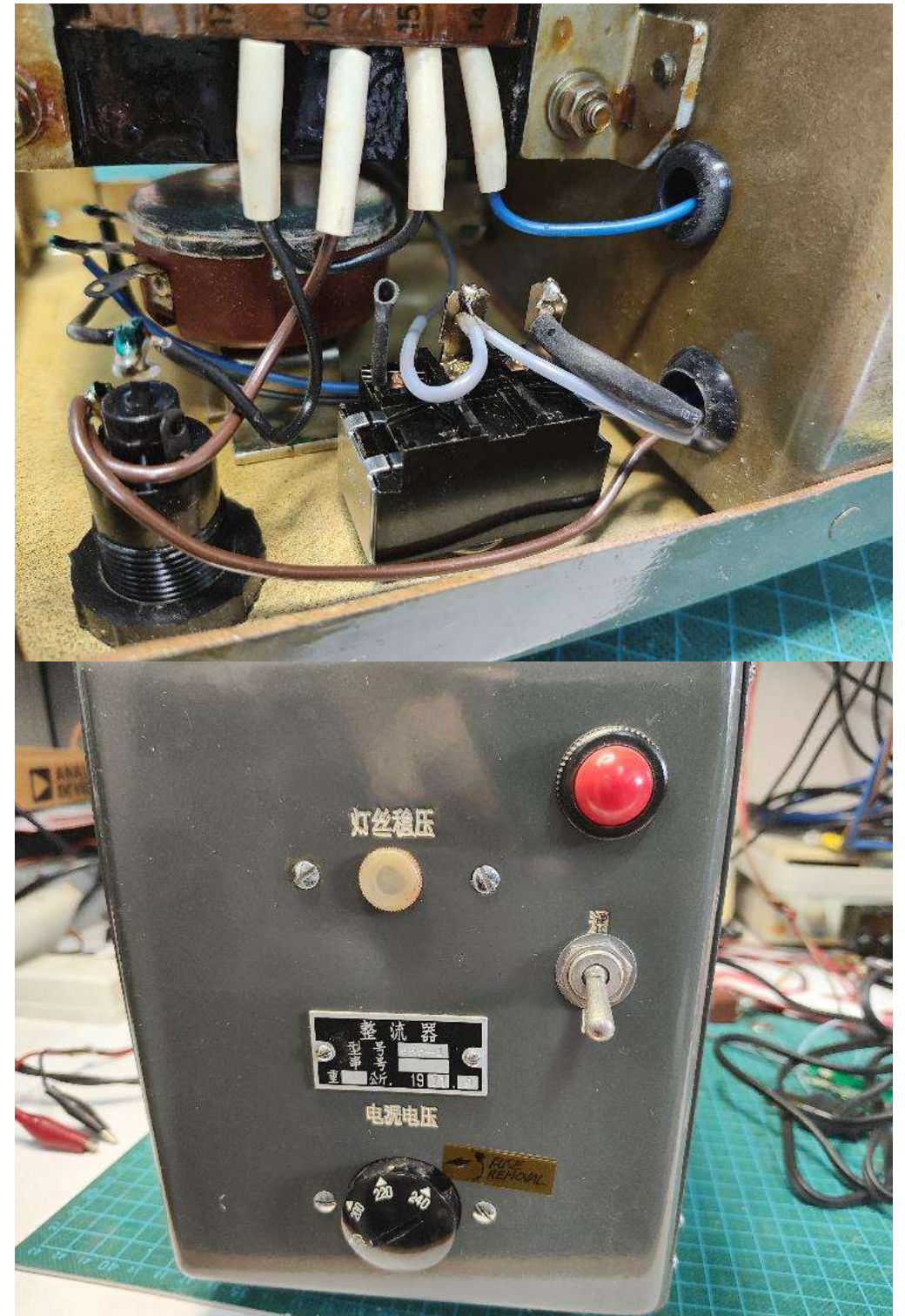
Original parts





1-Apr-2025

- Power switch broken when flipped to ON position, plastic toggle turned brittle after 50yrs
- Found connector CZ2 pin # 17/19 swapped during switch replacement, not big issue since these two pins are connected to another parallel switch inside 222-1 radio.
- Replaced power switch (250V 10A type w/agency approval), correct CZ2 wiring



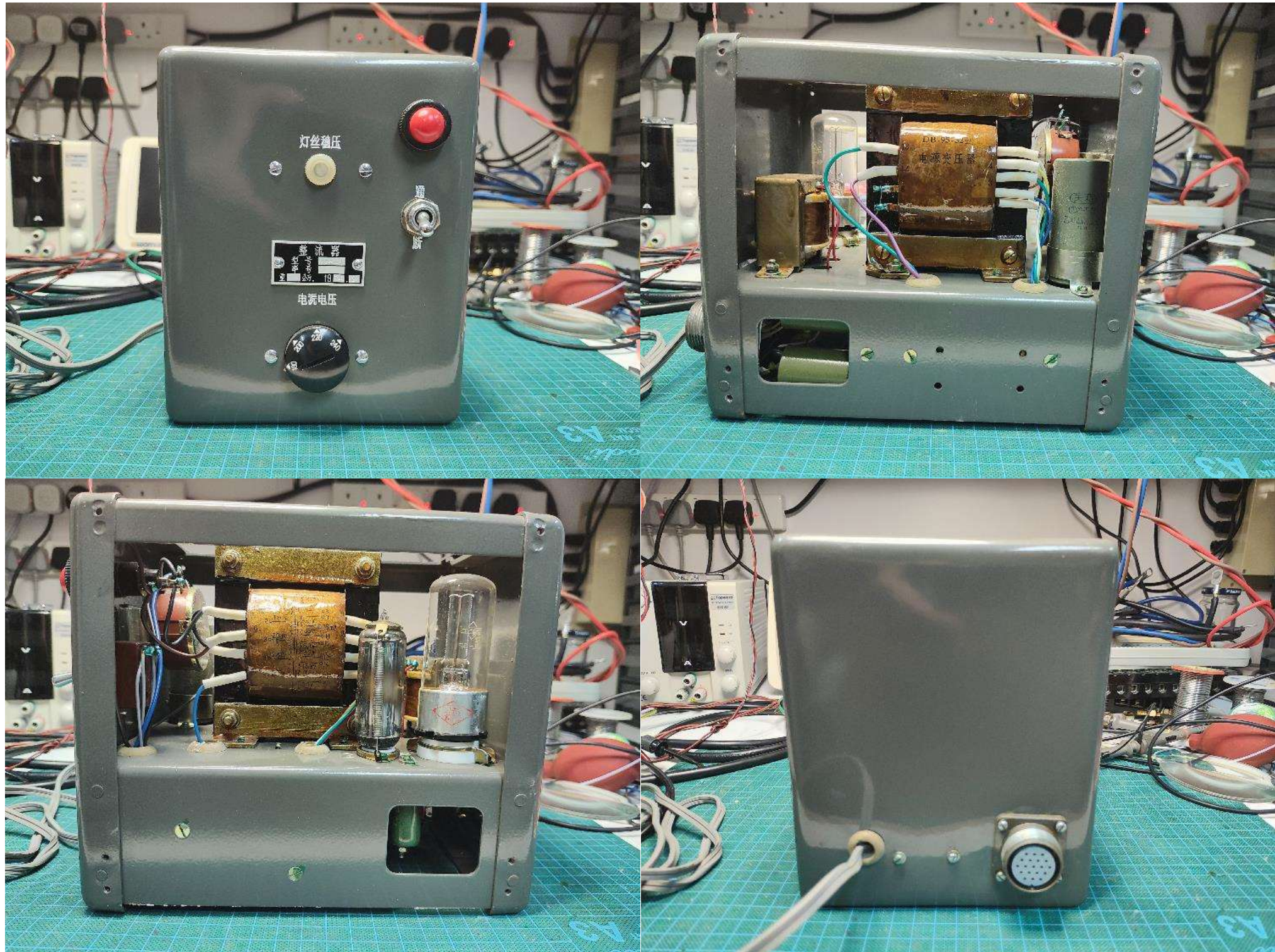


Unit #2 Feb-1974

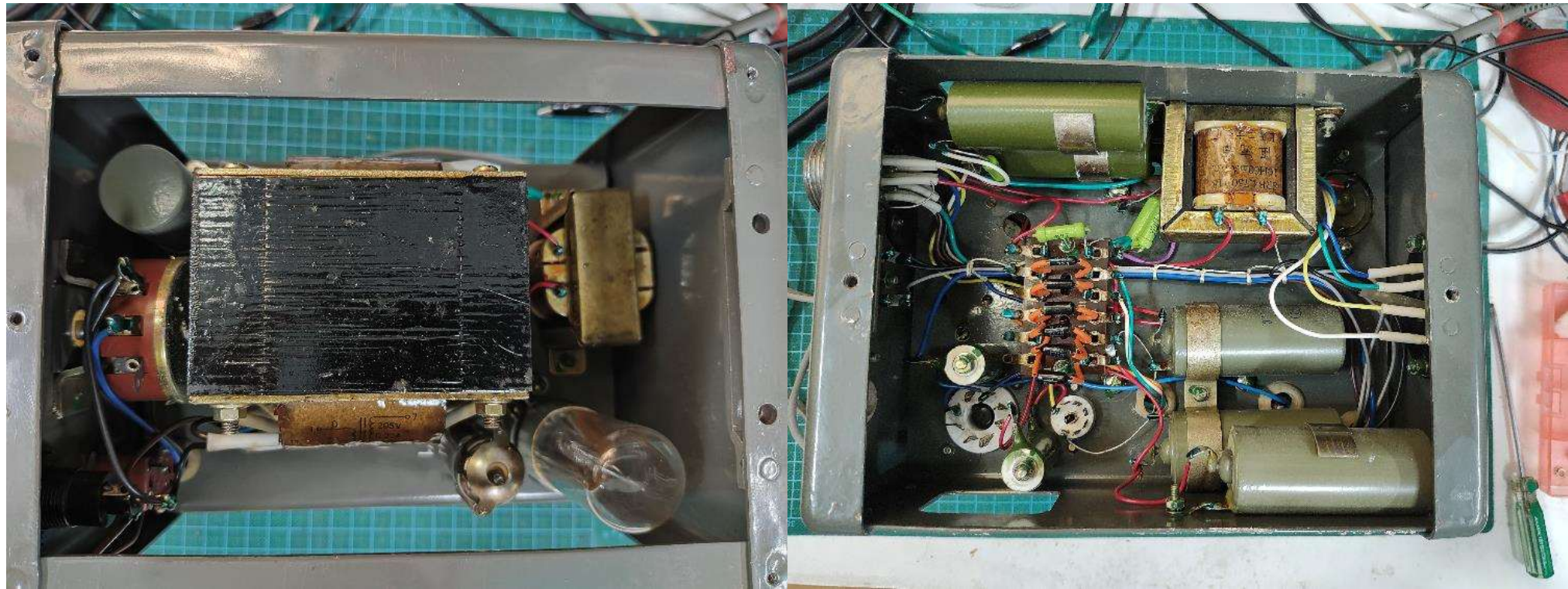


Before Service  
Better  
condition  
Than Unit #1

This one has a  
painted  
chassis  
instead of  
Zinc  
Chromate

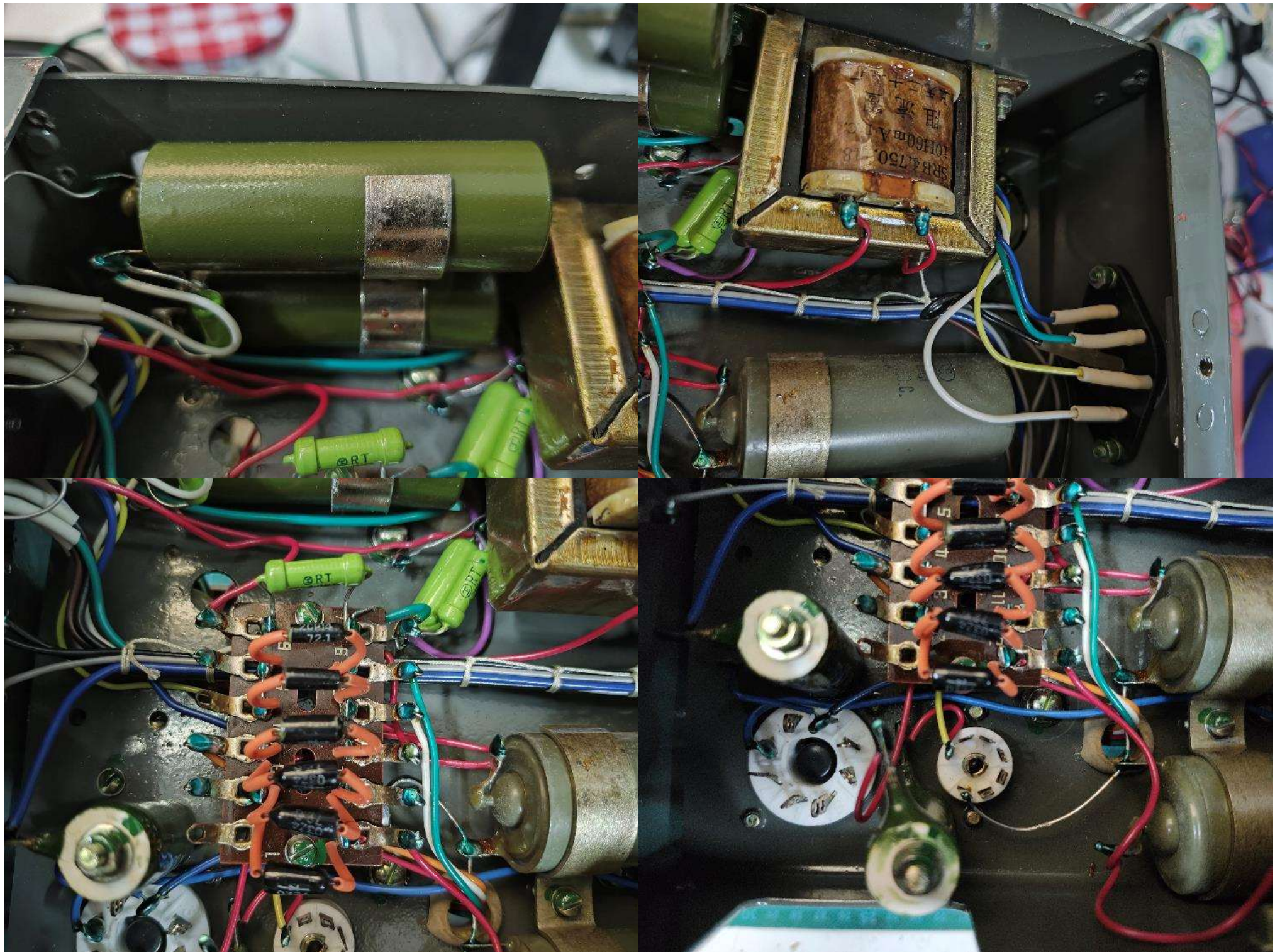




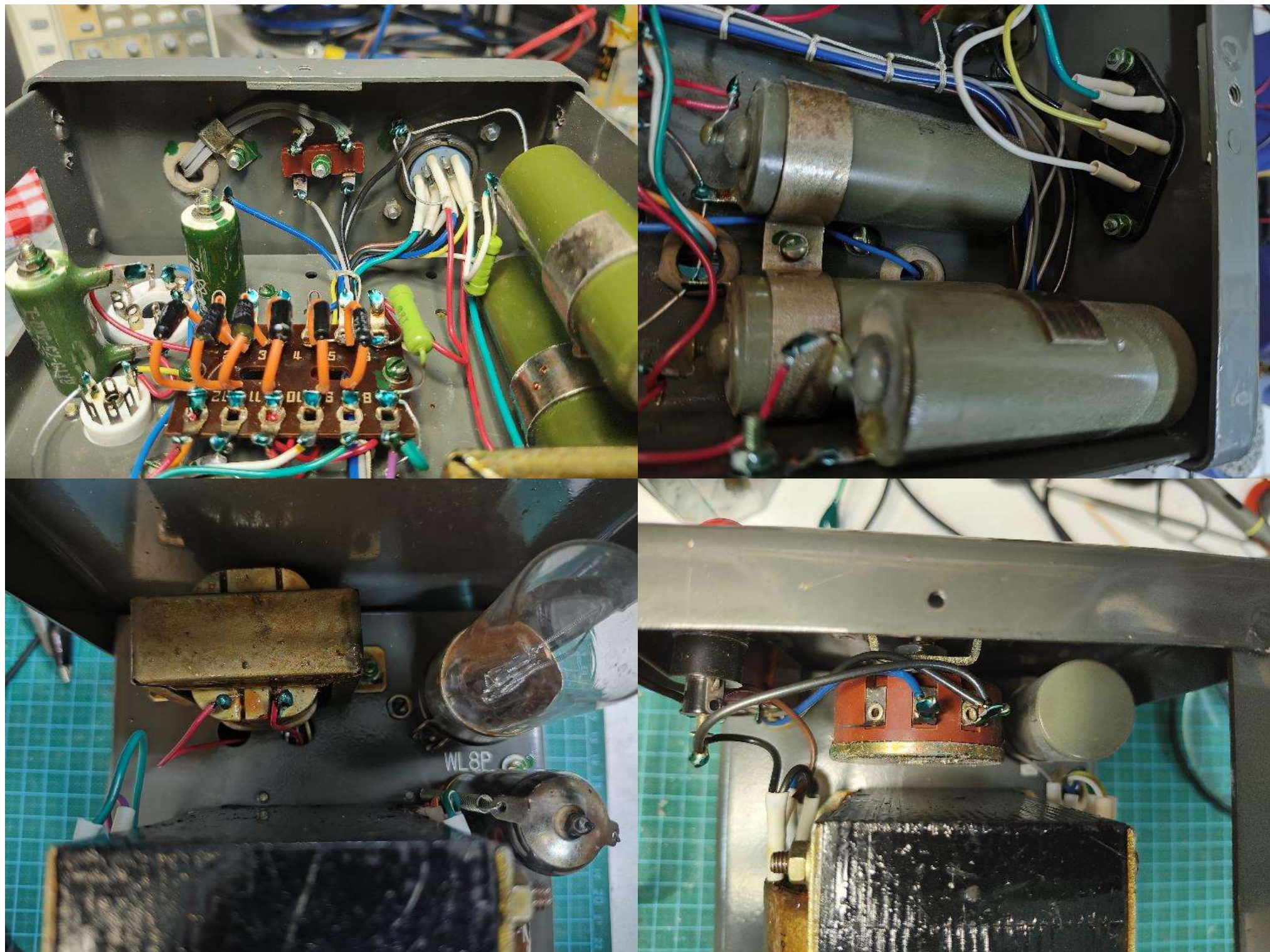




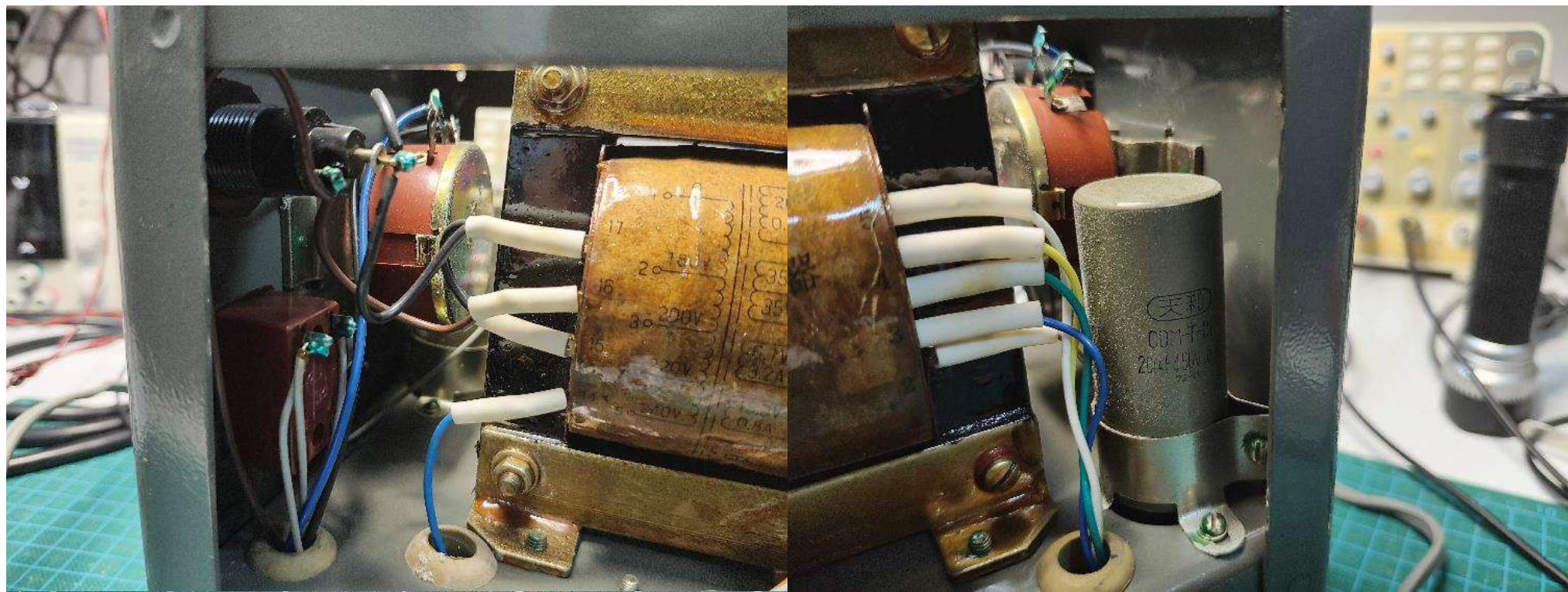
Internal  
close-up









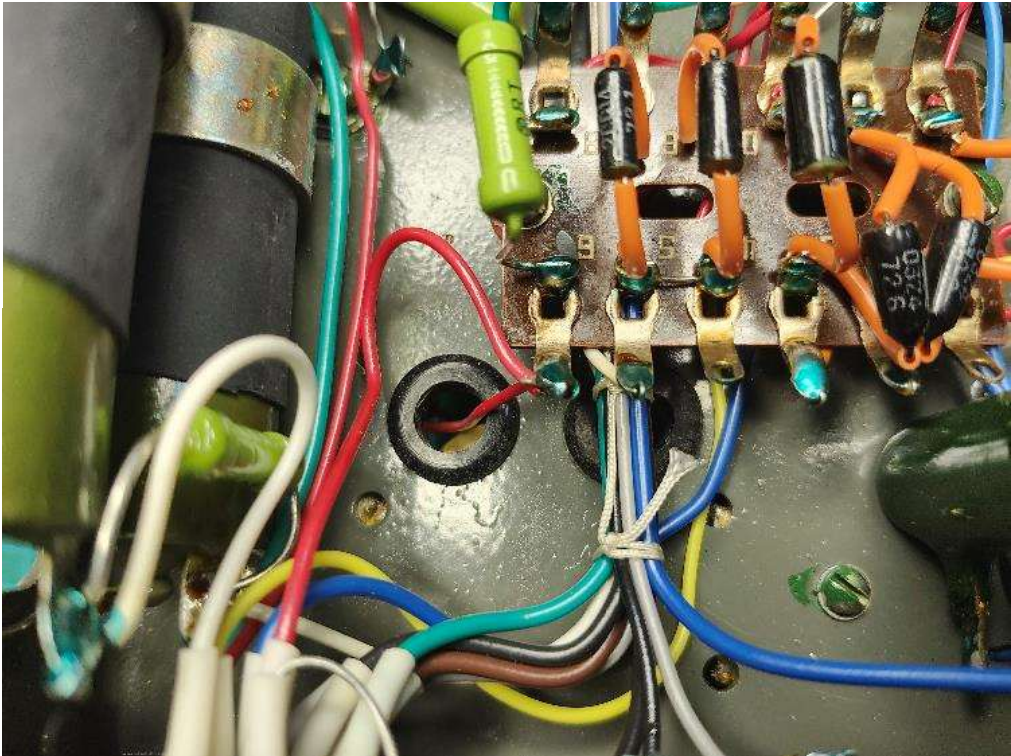


Rubber  
grommets  
removed





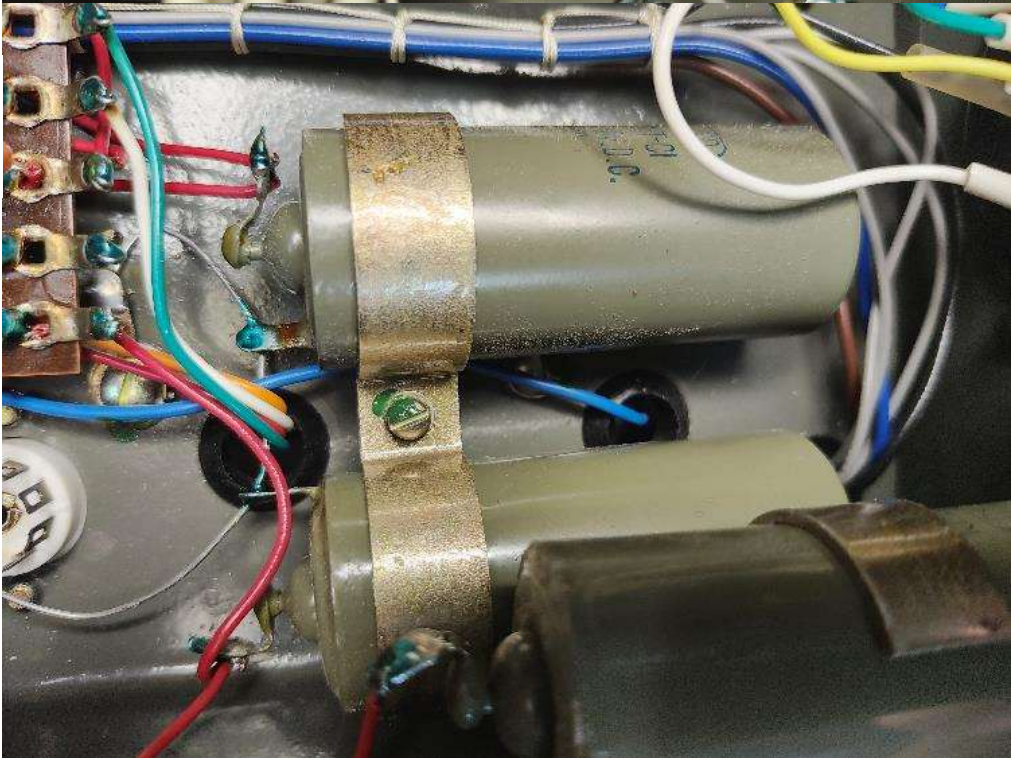
Rubber grommet replacement, rectifier diodes accidentally bent, later corrected. Diodes checked okay, not replaced



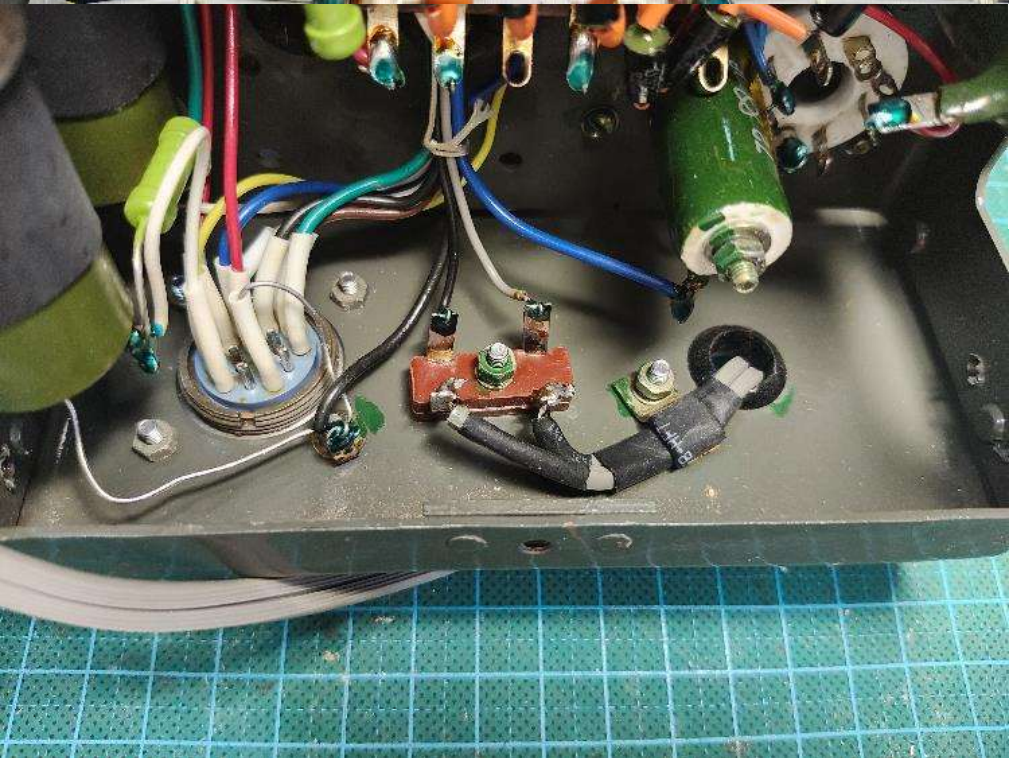
Heat shrinkable tubes on -40V capacitors. Retain original Ecaps. Ripple checked okay.



Rubber grommet replacement, retain original Ecaps

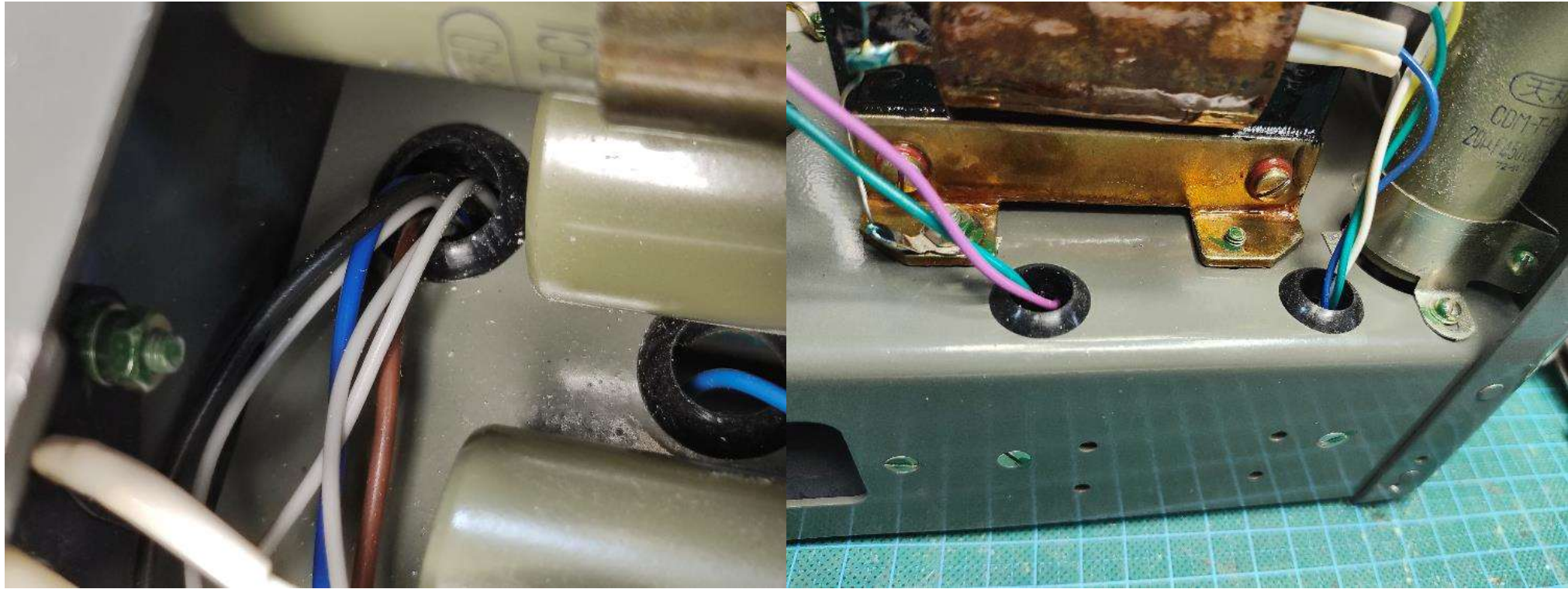


AC inlet grommet replacement and additional insulation, power cord condition acceptable, retained





Rubber grommet  
replacement



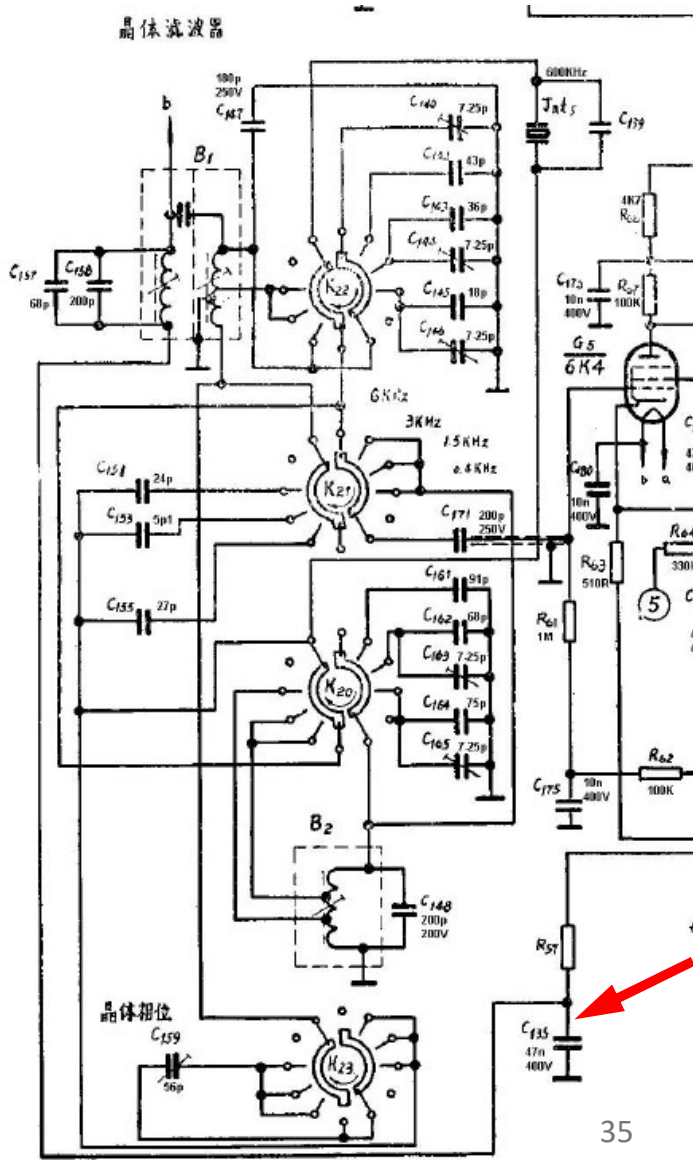
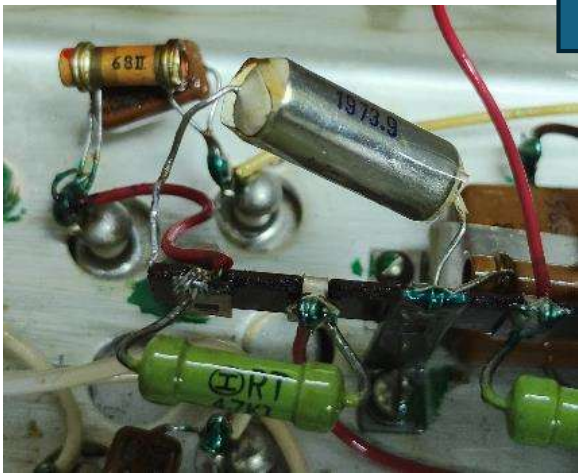


Metalized Paper Capacitor Check  
26-Apr-2025



Unit serial number 11849, 26-Apr-2025

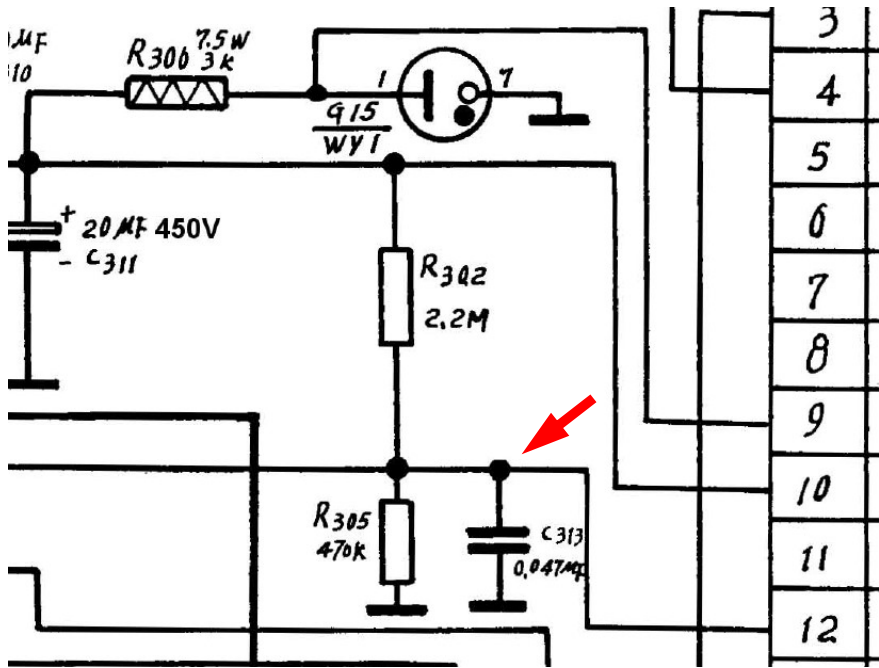
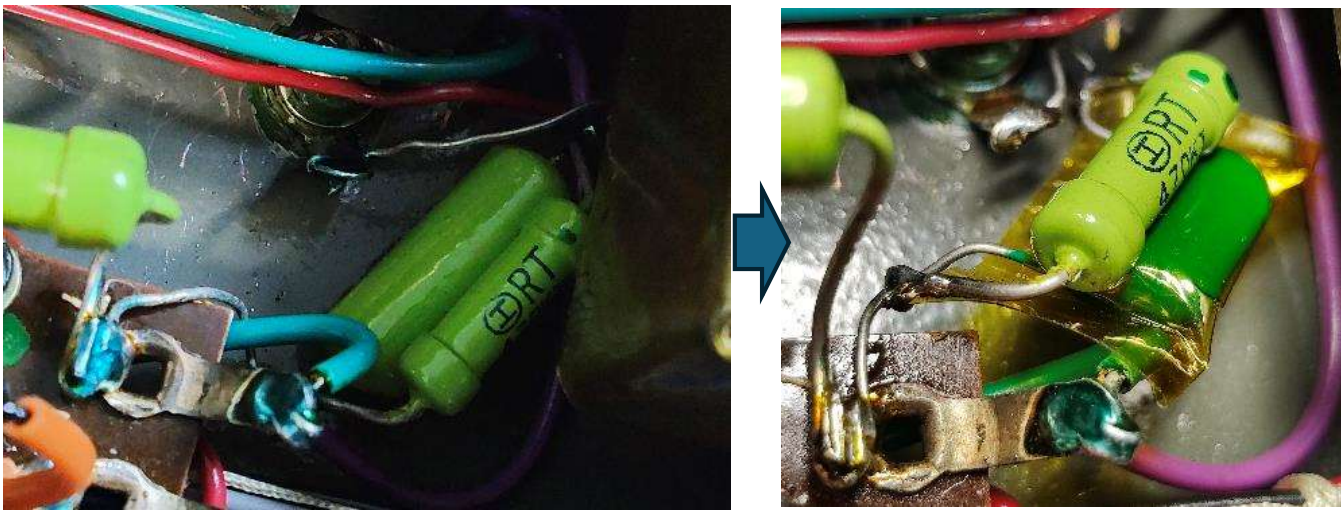
- Unit functional, capacitors were only visually inspected
- Picked one easy to remove capacitor for testing, this one was replaced irrespective of test result
  - pick C135, between mixer output and IF band pass filter 47n 400V
- C135, 0.047u 400V +/-10%, type CZJX, ( C-电容capacitor, Z纸-paper, J金属-metal ), date code 1973-9
  - 29.7n @100Hz, 29n @1KHz, 28n @100KHz, -36%
  - Leakage 0.27uA @200V DC
  - Replaced with Vishay Sprague 715P 47n 400V Polypropylene
- Capacitor deteriorated, schedule re-capping





Feb-1974 PSU, no S/N, metallized paper cap replacement, 26-Apr-2025

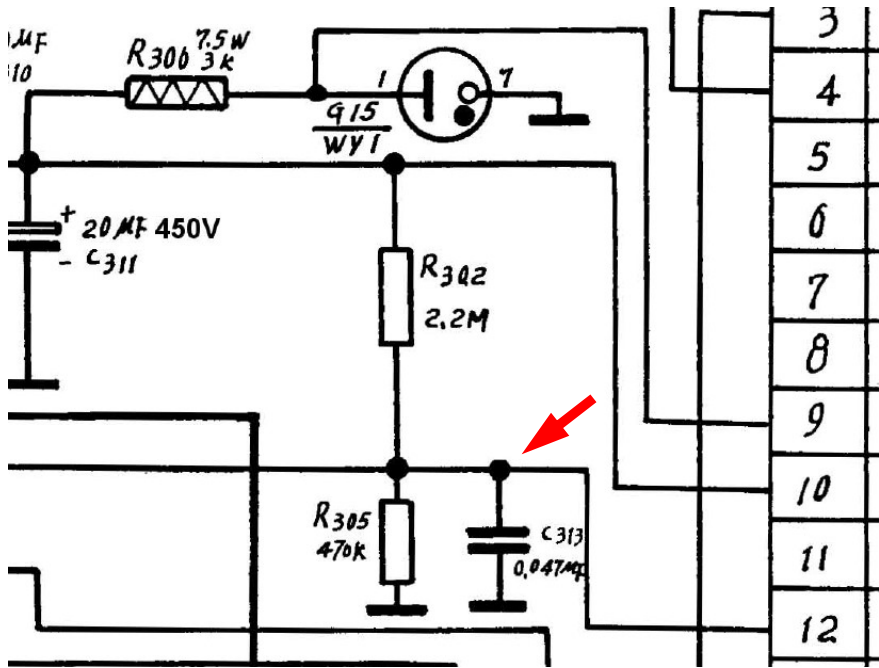
- Unit checked functional ~ 1 month ago, capacitor C313 not replaced for vintage reason.
- C313, 0.047u 400V +/-20%, type CZJX, date code 1973-9
  - 70n @100Hz, +48% tolerance
  - Leakage 22uA @200V DC, ~100x previous result **high**
  - Replaced with Marcon/Taitso 2G473K 47n 10% 400VDC polyester, space constrain
  - Resistor R305 470K in parallel with C313 de-soldered / re-installed





Sep-1971 PSU, no S/N, metallized paper cap replacement, 27-Apr-2025

- Unit checked functional ~ 1 month ago, capacitor C313 not replaced for vintage reason.
- C313, 0.047u 400V +/-20%, type CZJX, date code 1971-9
  - Oil leakage trapped inside jacket, marking partially dissolved
  - 21n @1KHz, -55%
  - Leakage 25uA @200V DC, **high**
  - Replaced with Marcon/Taitso 2G473K 47n 10% 400VDC polyester
  - Keep original R305 470K in parallel with C313 de-soldered / re-installed
- Confirmed capacitors questionable





- Notes:
- On tube replacement, Chinese 6K4 is equivalent to Russian/USSR 6K4n, has 7BD base pin 2 (suppressor grid g3) and 7(Cathode) are internally shorted, it is **NOT** 6BA6 compatible (7CC base, pin 2 and 7 separate) as described in many sources. A remote cutoff pentode with 7BD base is 9003, but Gm much lower than 6K4/6BA6
  - Chinese 6K7 has 7CC base, separate pin 2 & 7, compatible with 6BA6, only shortform spec available
  - 3-May-2025, correction to radio schematic on manual pg.56
    - G4 (6K4) used a 6K7 symbol with separate pin 7 (Cathode) and pin 2 (suppressor grid/shield), changed to 6K4 symbol

1.3.4 遥 截 止 五 极 管

| 序<br>号 | 型<br>号  | 结<br>构<br>与<br>用<br>途 | 类<br>别 | 灯<br>丝<br>电<br>压<br>U <sub>f</sub><br>(V) | 灯<br>丝<br>电<br>流<br>I <sub>f</sub><br>(mA) | 阳<br>极<br>电<br>压<br>U <sub>a</sub><br>(V) | 帘<br>栅<br>电<br>压<br>U <sub>g2</sub><br>(V) | 控<br>制<br>栅<br>电<br>压<br>U <sub>g1</sub><br>(V) | 抑<br>制<br>栅<br>电<br>压<br>U <sub>g3</sub><br>(V) | 阳<br>极<br>电<br>流<br>I <sub>a</sub><br>(mA) | 帘<br>栅<br>电<br>流<br>I <sub>g2</sub><br>(mA) | 跨<br>导<br>S<br>(mA/V) | 内<br>阻<br>R <sub>i</sub><br>(MΩ) | 阴<br>极<br>电<br>路<br>电<br>阻<br>R <sub>k</sub><br>(Ω) | 输<br>入<br>电<br>容<br>C <sub>gk</sub><br>(pF) | 输<br>出<br>电<br>容<br>C <sub>ak</sub><br>(pF) | 跨<br>路<br>电<br>容<br>C <sub>ag</sub><br>(pF) | 阳<br>极<br>电<br>压<br>U <sub>amax</sub><br>(V) | 帘<br>栅<br>电<br>压<br>U <sub>g2max</sub><br>(V) | 板<br>耗<br>P <sub>amax</sub><br>(W) | 栅<br>耗<br>P <sub>g2max</sub><br>(W) | 阴<br>极<br>电<br>流<br>I <sub>k</sub><br>(mA) | 灯<br>间<br>丝<br>与<br>电<br>阴<br>极<br>压<br>U <sub>fk</sub><br>(V) | 控<br>制<br>栅<br>电<br>路<br>电<br>阻<br>R <sub>g1</sub><br>(MΩ) | 外<br>形<br>图 | 电<br>极<br>接<br>线<br>图 | 国<br>外<br>类<br>似<br>型<br>号 | 备<br>注 | 序<br>号 |
|--------|---------|-----------------------|--------|---|--|---|--|---|---|--|---|-----------------------|----------------------------------|---|---|---|---|--|---|------------------------------------|-------------------------------------|--|--|--|-------------|-----------------------|----------------------------|--------|--------|
| 1      | 6K2B(T) | 高频电压放大                | 超小型    | 6.3                                       | 200  | 120                                       | 120  | 自偏  | 0   | 7.5  | ≤4.0  | 4.8                   |                                  | 200   | 5   | 4   | ≤0.035                                      | 150  | 125   | 1.2                                | 0.3                                 | 14   | ±150   | 1  | D1.3.1-4    | B1.3-36               | 6K1Б                       |        | 1      |
| 2      | 6K3P    | 高频电压放大                | 八脚管    | 6.3                                       | 300  | 250                                       | 100  | -3  | 0   | 9.25                                       | 2.5   | 2                     | 0.85                             | 68  | 6.5   | 7   | ≤0.007                                      | 330  | 140   | 4.4                                | 0.44                                |  | ±100   |  | D1.3.3-2    | B1.3-37               | 6K3,6SK7-GT                |        | 2      |
| 3      | 6K4     | 中频、高频电压放大             | 拇指管    | 6.3                                       | 300  | 250                                       | 100  |   |   | 10   | ≤5.5  | 4.4                   | 0.85                             | 68  | 6   | 6.3   | ≤0.0045                                     | 300  | 125   | 3                                  | 0.6                                 | 20   | ±100   |  | D1.1.4-4    | B1.3-38               | 6BA6,6F31,6K4Π             |        | 3      |
| 4      | 6K5     | 同上                    | 同上     | 6.3                                       | 300  | 250                                       | 100  |   | 0   | 10   | ≤5.5  | 4.4                   | 0.5                              | 100   | 6   | 5.8   | ≤0.0045                                     | 300  | 125   | 3                                  | 0.6                                 | 20   | ±100   | 0.5  | D1.1.4-4    | B1.3-38               | EF93                       |        | 4      |
| 5      | 6K7     | 高频电压放大                | 同上     | 6.3                                       | 300  | 250                                       | 150  |   |   | 11   | ≤3.5  | 5.7                   |                                  |   |   |   |   | 300  | 150   | 3.5                                | 0.5                                 | 18   | ±200   | 0.5  | D1.1.4-4    |                       | 6K7Π                       |        | 5      |
| 6      | 12K3P   | 同上                    | 八脚管    | 12.6                                      | 150  | 250                                       | 100  | -3  | 0   | 9.25                                       | 2.5   | 2                     |                                  |   | 6   | 7   | 0.007                                       | 330  | 140   | 4.4                                | 0.44                                |  | 100  |  | D1.3.3-2    | B1.3-37               | 12K3,12SK7-GT              |        | 6      |

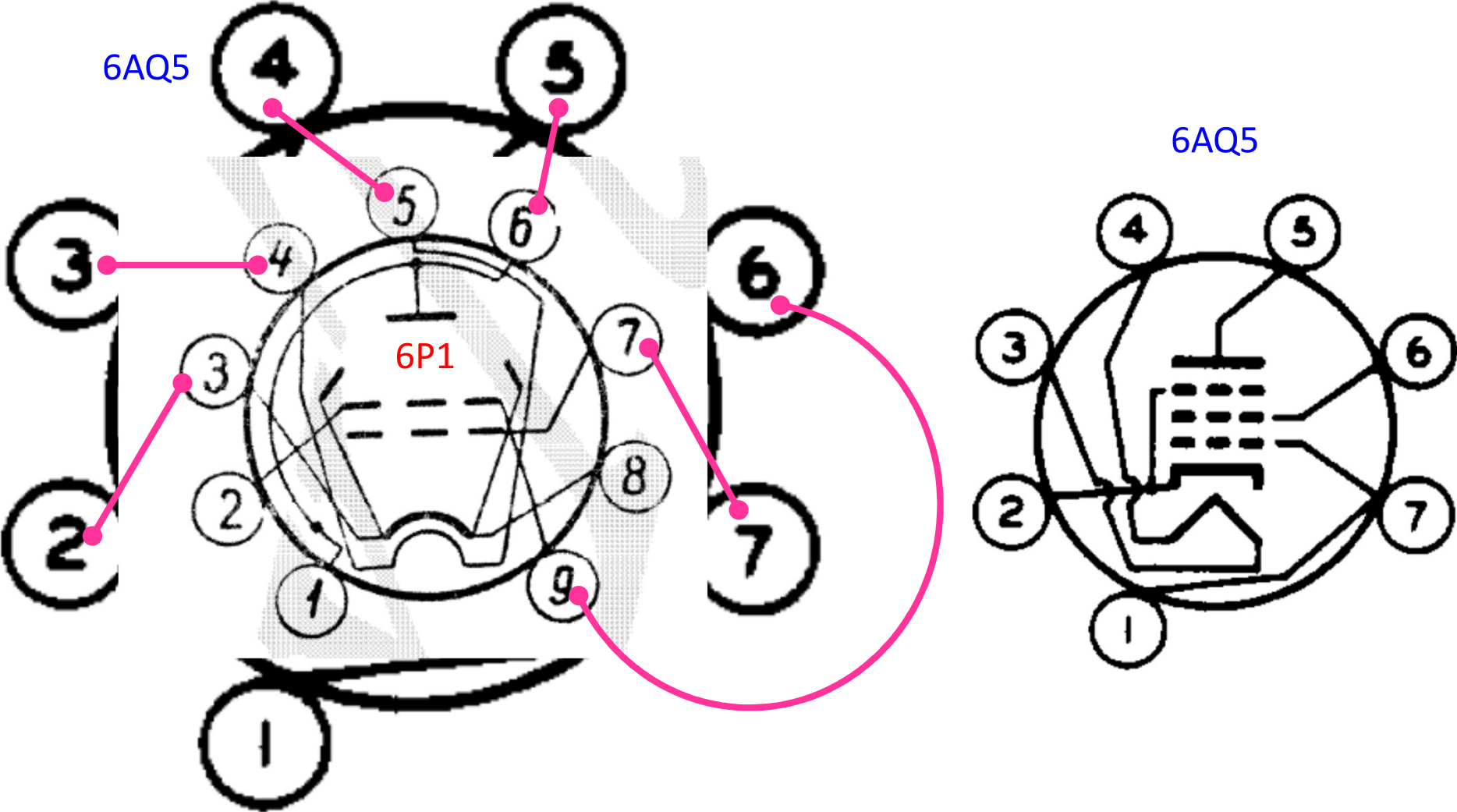


4-May-2025, tube compliment

| Legend | Chinese      | Russian  | American | European | Base | Comment  |
|--------|--------------|----------|----------|----------|------|--|
| G1     | 6K7 class J  | 6K7П TBD | 6BA6     |          | 7CC  | Pentode, remote cutoff                                 |
| G2     | 6K7 class J  | 6K7П TBD | 6BA6     |          | 7CC  | Pentode, remote cutoff                                 |
| G3     | 6U1          | 6И1П     | 6AJ8     | ECH81    | 9CA  | Triode-Heptode   |
| G4     | 6K4 class J  | 6K4П     |          |          | 7BD  | Pentode, remote cutoff                                 |
| G5     | 6K4 class J  | 6K4П     |          |          | 7BD  | Pentode, remote cutoff                                 |
| G6     | 6K4 class J  | 6K4П     |          |          | 7BD  | Pentode, remote cutoff                                 |
| G7     | 6K4 class J  | 6K4П     |          |          | 7BD  | Pentode, remote cutoff                                 |
| G8     | 6H2          | 6X2П     | 6AL5     | EB91     | 6BT  | Twin diode   |
| G9     | 6J1 class J  | 6Ж1P     | 6AK5     | EF95     | 7BD  | Pentode, sharp cutoff                                  |
| G10    | 6F2          | 6Ф2П     | 6U8      | ECF82    | 9AE  | Triode-Pentode   |
| G11    | 6P1 class J  | 6П1П     |          |          |      | No Western equivalent                                  |
| G12    | 6K4 class J  | 6K4П     |          |          | 7BD  | Pentode, remote cutoff                                 |
| G13    | WL8P         |          | 9-8      |          |      | Ballast tube, 900mA, 8V, Amperite 9-8 different pinout |
| G15    | WY-1 class J | СГ1П     | 0A2      | STR150   | 5BO  | Regulator 150V   |



6AQ5 to 6P1 conversion, rarely required as 6P1 available for reasonable price  
6AQ5 is close to 6P1 in terms of application and characteristic, requires 7pin to 9pin base conversion, fortunately most pins in good order agreement. Conversion plugs available from audio retailers.





End of document